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Korea
Appraisal of
Rural Infrastructure Project

February 15, 1976

East Asia & Pacific Projects
Irrigation Division

FOR OFFICIAL USE ONLY

International Bank for Reconstruction and Development
International Development Association

CURRENCY EQUIVALENTS

US$1.00	=	Won 485
Won 1,000	=	US$2.06
US$1 million	=	Won 0.485 billion
Won 1 million	=	US$2,062

WEIGHTS AND MEASURES (METRIC SYSTEM)

1 meter (m)	=	3.28 feet (ft)
1 kilometer (km)	=	0.62 miles
1 hectare (ha)	=	2.47 acres
1 million cubic meters (Mm^3)	=	810 acre-feet
1 cubic meter per second (m^3/s)	=	35.3 ft^3/s (cusec)
1 ton	=	1,000 kilogram (kg)
	=	2,205 pounds
1 megawatt (MW)	=	1,340 horsepower (hp)

NOTATION

-- Less than half the smallest unit shown
- Nil or negligible
... Not available separately but included in total
.. Not available
. Not applicable
e Mission estimate

ABBREVIATIONS

ACSR	-	Aluminum Conductor (Steel Reinforced)
ADC	-	Agricultural Development Corporation
cif	-	Cost, insurance and freight
EPB	-	Economic Planning Board
FAO	-	Food and Agriculture Organization of the United Nations
fob	-	Free on board
FEDC	-	Farmland Expansion and Development Corps (of ADC)
FLIA	-	Farmland Improvement Association
GNP	-	Gross National Product
GVP	-	Gross Value of Product
ICB	-	International Competitive Bidding
KDB	-	Korea Development Bank
KECO	-	Korea Electric Company
LCB	-	Local Competitive Bidding
MAF	-	Ministry of Agriculture and Fisheries
MCI	-	Ministry of Commerce and Industry
MHA	-	Ministry of Home Affairs
MHSA	-	Ministry of Health and Social Affairs
MOC	-	Ministry of Construction
NACF	-	National Agricultural Cooperative Federation
OOF	-	Office of Forestry
ORD	-	Office of Rural Development
OSROK	-	Office of Supply of the Republic of Korea
pH	-	A measure of acidity
PVC	-	Polyvinylchloride
UNDP	-	United Nations Development Program
UNICEF	-	United Nations International Children's Emergency Fund
USAID	-	United States Agency for International Development
VFA	-	Village Forestry Association
WHO	-	World Health Organization

GLOSSARY

Do	-	Province
Gun	-	County
Myon	-	District
Ri	-	Village
Hung Nong Gae	-	"Farmers' Action Group" - Water Users' Association
Saemaeul Undong	-	New Community Movement
Tongil	-	A high-yielding rice variety
Chigae	-	A-frame for human portage
Ondol	-	Under-floor heating system

FISCAL YEAR

January 1 - December 31

KOREA

APPRAISAL OF THE RURAL INFRASTRUCTURE PROJECT

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REFERENCE

1. Leslie E. Shanan (Consultant); "Proposed Guidelines for Upland Development in the Rural Infrastructure Project and the Watershed Development Project," October 1, 1975 (available on request).

KOREA

APPRAISAL OF THE RURAL INFRASTRUCTURE PROJECT

SUMMARY AND CONCLUSIONS

i. The proposed project would be the first Bank-assisted multi-sectoral rural development project in Korea and includes minor irrigation, upland reclamation, fuelwood, roads and bridges, water supply and rural electrification components. The project has been formulated within the Saemaeul Undong (New Community Movement), a national rural development program in which villages set their own development priorities and contribute, in cash or kind, to the selected projects. The Saemaeul Movement began in 1971 and, even though this appraisal did not attempt to review the entire Movement in depth, it has clearly made an impressive contribution, both in physical terms and in the modernization of rural attitudes and the building of institutions at the village level, capable of planning, financing and executing development projects with a minimum of government assistance. The government's plans call for all Korea's 35,000 villages to reach this "self-reliant" stage by 1981 and the proposed project would assist this process.

ii. Korea's economic development since 1963 has been impressive, with an average growth rate in GNP of 10% per annum in real terms. This has been mainly achieved by concentration on export-oriented industries -- the growth rate in agriculture has been a moderate 3.5% per year and annual grain imports have increased to 3 million tons in recent years. Since the end of 1973, the economy has received a sharp setback, as a result of the energy crisis and the world recession. The result has been increased inflation, unemployment and an adverse balance of payments. The project would go some way towards alleviating these developments, by utilizing nearly 14 million man-days of seasonally underemployed rural labor for project construction. In addition, the project would create at least 3,900 permanent jobs.

iii. Owing to the mountainous topography and the high population density in Korea, few opportunities exist for expanding the existing cropped area of 2.2 million ha. Double-cropping is limited by climatic factors but could be expanded with increased water control and the development of shorter-duration varieties of rice and other grains. There are about 200,000 ha of uplands which could be cultivated but the existing methods of development will require refinement and testing before this target can be achieved. Most of Korea's mountain land is forested but is under heavy pressure to meet demands for fuelwood. Consequently, the Government has instituted a program to establish fuelwood blocks adjacent to the villages. A basic necessity for most rural development activities is the provision of road access to each village and this is therefore a major component of the Saemaeul Movement. Rural income has already reached the point where the rural people are demanding urban-type services, such as electricity and piped water, and have demonstrated their willingness to contribute at an appropriate level to such infrastructure.

iv. Project works include 66 minor irrigation sub-projects, ranging from 50 to 700 ha in size, 35 upland development areas, 11,000 fuelwood plantations, 850 km of village roads and 200 bridges, water supplies for 2,000 villages, and 2,400 rural electrification schemes. The project would serve about 15,000 villages in all. Except for upland reclamation, where newly-devised design techniques would be put into practice, under the guidance of an international adviser, these sub-projects would be similar to those implemented in recent years. However, improved design criteria and construction methods have been incorporated into several of the components. The project also includes a program to improve hydrologic measurements and analysis throughout Korea, which would require the services of an international consulting firm.

v. Quantitative sub-project selection criteria have been used by the Government for the first time for rural development projects in Korea in preparing this project. In addition, the development priorities of the villagers and their past record in the Saemaeul Movement are given considerable weight. A master list of sub-projects, largely agreed upon at negotiations, would form the basis for project monitoring and supervision. Detailed design work is proceeding and would be mainly completed before the beginning of construction in March, 1976. Construction would be generally completed in two years with some of the larger works, as well as studies and evaluation, continuing through 1978.

vi. Total project costs are estimated at US$143.5 million, of which US$60.0 million (42%) would be foreign exchange. This cost does not include the value of volunteer labor, which would be used to construct the fuelwood, roads and bridges, and water supply components. The proposed Bank Loans totalling US$60.0 million would finance the foreign exchange requirements of the project. Internally, sub-projects would be financed by a combination of loans and subsidies from the Central and Provincial Governments and contributions (in volunteer labor) from the beneficiaries. The execution of a Subsidiary Loan Agreement with the Korea Electric Company would be a condition of disbursement for the rural electrification component.

vii. Except for materials to be procured through local shopping, all equipment and materials would be procured through the Office of Supply. Goods which would be procured in small quantities or which by their nature would not be of interest to foreign suppliers (estimated to cost US$14 million) would be procured through local competitive bidding procedures acceptable to the Bank. Other centrally-procured equipment and materials (estimated to cost US$23 million) would be procured through international competitive bidding following Bank guidelines. To enable construction to begin early in 1976, up to US$9.0 million worth of materials for roads, bridges and water supply would be procured through local shopping. Transplants and fertilizer for the fuelwood component (estimated to cost US$10 million) would also be procured through local shopping. As the 15,000 or so sub-projects are small and scattered, the civil works could not be grouped into packages large enough to interest international contractors and would thus be subject to local competitive bidding (minor irrigation, upland reclamation and rural electrification) or constructed by volunteer village labor. Disbursements

would not be made directly against materials procured through local procedures but would be included in a standard percentage of disbursement against completed civil works.

viii. Auditing provisions would include financial auditing by the auditing sections of the Ministries and independent auditors, as well as spot-checking of the physical progress of the project by the responsible Ministries and Bank supervision missions.

ix. The following table shows, for each component, the responsible Ministry and the executing agency:

Component	Ministry	Executing Agency
Minor Irrigation	Agriculture and Fisheries	Farmland Improvement Associations
Upland Reclamation	Agriculture and Fisheries	Counties
Fuelwood	Home Affairs	Village Forestry Associations
Roads and Bridges	Home Affairs	Provinces, Counties
Water Supply	Health and Social Affairs	Counties
Rural Electrification	Commerce and Industry	Korea Electric Company

For the minor irrigation and upland reclamation components, technical services would be provided by the Agricultural Development Corporation. Improvements to Hydrologic Services would be carried out by the Ministry of Construction. Training, both in-service and overseas, would be included in the project.

x. Irrigation systems would be operated and maintained by the Farmland Improvement Associations, who would also collect water charges. The Korea Electric Company would operate the power systems. All other components would be maintained by the villagers themselves. Loan repayment terms for minor irrigation and upland reclamation, in line with national policy, would imply cost recovery indices of 23% and 28% respectively, which are considered satisfactory, taking into account the income levels of the beneficiaries, the size of the "project rent" and allowances for risk and uncertainty. The cost of rural electrification would be fully recovered, while the villagers' contribution to the capital costs of the fuelwood, roads and bridges, and water supply components, mostly in the form of labor, would equal 45%, 40% and 35% respectively. In addition, the villagers would meet all recurrent costs.

xi. The progress of the project would be monitored by the Economic Planning Board (EPB), through a system of quarterly reports. The executing agencies would report to EPB, through their respective Ministries, and EPB

would forward a summary to the Bank, as a basis for its disbursement applications. EPB would also be responsible for setting up a program of evaluation studies, to be carried out mostly by other agencies. These studies would measure project benefits, the effectiveness of the institutional structure and the social impact of the project.

xii. Agricultural research and extension services in Korea are generally adequate. Additional extension staff would be deployed to support the minor irrigation component. Extension personnel would be given additional training in soil conservation practices and assigned to the upland reclamation sub-projects. The availability of agricultural credit and seeds would be adequate to meet the needs of the project.

xiii. The proposed project would benefit about four million rural people (about 30% of Korea's rural population), increase rural incomes and employment opportunities, develop the ability of the rural people to plan and implement projects, and improve the quality of rural life. The number of beneficiaries is high because there would be little "overlap" between the sub-projects in the various sectors. Using a seasonal shadow price for labor, the economic rate of return would be about 13% for irrigation, 21% for upland reclamation, 19% for fuelwood, and 10% for rural electrification (based on revenue projections as a measure of willingness to pay and thus ignoring the consumers' surplus). For roads, the rate of return would be at least 8% for each sub-project and has been estimated at 16% for a typical sub-project. Water supply is justified mainly as a contribution to the quality of rural life. The project would have a positive effect on income distribution and on Korea's balance of payments.

xiv. With appropriate assurances, the proposed project would be suitable for a Bank loan of US$20.0 million and an Intermediate Term Loan of US$40.0 million, both with twenty-five-year maturities and seven-year grace periods, following previous practice for agricultural projects in Korea. The borrower would be the Republic of Korea.

KOREA

APPRAISAL OF THE RURAL INFRASTRUCTURE PROJECT

I. INTRODUCTION

1.01 The Government of the Republic of Korea has requested Bank assistance in financing a multi-sectoral nationwide Rural Infrastructure Project. Bank assistance would allow the pace of development in some rural sectors to be accelerated and, in others, to be maintained in the face of increasing budgetary constraints. The Project has been formulated within the broad program of the Saemaeul Undong (New Community Movement), a national approach to rural development, which affects virtually all public sector investments in the rural areas and which is based largely on decentralized decision-making and self-help from the villagers. Under the project, present methods of sub-project selection, design and construction would be improved, and a system of monitoring and evaluation would be introduced. The project would meet high-priority needs in minor irrigation, upland reclamation, fuelwood, roads and bridges, water supplies and rural electrification. This project would be the first Bank Group investment for multi-sectoral rural development in Korea. Previous related Bank Group investments in Korea include two large-scale irrigation projects, two livestock projects, projects for seeds, agricultural products processing and agricultural credit, and three highway projects (para 2.18).

1.02 The project was prepared by the Government in 1974-75, the work of the various Ministries being coordinated and compiled by the Economic Planning Board. Preparation of the minor irrigation and upland reclamation components made use of the results of the UNDP/FAO "Upland Development and Watershed Management Project" (AGL/ROK 67/522), completed in 1973. The present report is based on the findings of a pre-appraisal mission, comprising Messrs. P. W. Whitford, K. V. S. K. Nathan and R. H. Sheehan (Bank), and Messrs. H. Boumendil, J. G. Devitt and C. D. Spangler (consultants), which visited Korea in March-April, 1975 and an appraisal mission, comprising Messrs. P. W. Whitford, R. S. Baskett, J. P. Gittinger, C. G. Goldfinger, H. Maeda and K. V. S. K. Nathan (Bank), and Messrs. E. Gelb and L. E. Shanan (consultants), who visited Korea in July-August, 1975.

II. BACKGROUND

General

2.01 The Republic of Korea covers an area of 98,000 km^2 (Map 10375). The topography is comparatively rugged (Annex 1) and crops are confined to the valley floors, the lower hillsides and some coastal plains. Korea's climate shows pronounced seasonal variations, with cold, dry winters and hot, humid summers. About 60% of the annual rainfall, which averages from 800 mm to 1,400 mm in various regions, falls during the summer growing

season (June to September) (Map 10376). The river system is well developed but strong seasonal variations in flow and rather frequent flooding are characteristic.

2.02 The mid-1975 population is estimated at 34.0 million, with a recent growth rate of 1.7%. The Government expects to reduce this growth rate to 1.3% by 1980. Population density (including the urban population) is nearly 350 per km^2 overall, or 1,500 per km^2 of cropped land (Map 10377). By comparison, population density on Java is 600 per km^2 overall or 750 per km^2 of cropped land. About 45% of Korea's population is rural and there are about 2.5 million farm households, mainly located in the 35,000 or so villages.

The Economy

2.03 Beginning from a position uncomfortably close to the bottom of the international income scale and having limited physical resources, little international trade and limited development experience, Korea embarked in the early 1960's on a course of export-led industrial growth that became one of the outstanding success stories in international development. From 1963 to 1972, real GNP rose at an average annual rate of nearly 10% and per capita GNP doubled. Rapid growth continued in 1973 (17% in real terms) and the first half of 1974. The 1974 GNP is estimated at US$475 per capita.

2.04 The driving force behind Korea's growth has been industrial exports, mainly textiles, clothing, plywood and electronics. The industrial base is now being deepened to include iron and steel, machinery, shipbuilding, and chemical industries. Income distribution in Korea is generally more equitable than in comparable developing countries, with the lowest quintile of the population receiving 10% of national income. Mainly because of adjustments to input and crop prices, the gap between rural and urban incomes has narrowed considerably in the last few years. Household incomes in rural areas are now about equal to those of households in urban areas but the average income of an agricultural worker is still only 46% that of his urban counterpart.

2.05 Since the end of 1973, the Korean economy has been struck by the twin shocks of sharply increased world prices for fuel, food and raw materials and the protracted recession in the industrialized countries which buy Korean exports. This has led to sharply increased inflation (for example, a 26% rise in consumer prices in 1974), rising unemployment and a rapid drawdown of Korea's foreign exchange reserves. Government response to these events included a 17.5% devaluation of the Won, gradual adjustment of domestic prices towards world market levels, intensive export promotion, and the seeking of additional medium- and long-term funds from abroad. Fiscal measures included increased excise taxes and a new sales tax. While current account deficits are likely to continue for some years, Korea's longer term prospects are bright, with an average growth rate in GNP of 8% per annum appearing likely.

2.06 The growth rate of valued added in agriculture in Korea averaged about 3.5% per annum in real terms during 1962-72 (Annex 15). Growth accelerated in 1973 and 1974 to 5.5% and 6.9% respectively but this was mainly due to rapid growth in the livestock and fisheries sub-sectors. Total foodgrain production has grown little in the last decade, standing at about 7.2 million tons, the steady rise in rice production being counter-balanced by declines in the other major food crops. Thus total grain imports have increased from 700,000 tons annually in 1962-64 to 3 million tons in recent years, or a decline in the degree of self-sufficiency from 90% to 70%. The cost of imported grain in 1974 was US$640 million. Prospects for reversing this trend are not good, as demand is increasing at 2.5% per year and the supply of cultivable land is quite limited. However, self-sufficiency in rice production can be expected within a few years.

Rural Conditions in Korea

2.07 The average farm size in Korea is about 0.9 ha, of which 0.5 ha is paddy land (para 2.09), while the remainder grows upland crops, such as barley, maize, soybeans, fruit, vegetables, tobacco, mulberries (for silkworm production) and other cash crops. Nearly two-thirds of farm households have less than 1 ha of cropland but only 4% of farm households are landless. The national farm size distribution is given in Annex 1. Most farmers own the land they cultivate, 70% being full owners and a further 23% renting some land in addition to their own. This equitable distribution of land ownership is the result of the Farmland Reform Laws of 1945 and 1950, which imposed a ceiling of 3 ha on cultivated land per household.

2.08 All uncultivated land in Korea (about 67% of the total area) is classified as forest but most high-grade timber production comes from the 840,000 ha (9%) of National Forests (Map 10380). Most of the remaining "forest" is privately owned in small holdings. The average holding size is 2.6 ha but the median size is less than 1 ha, with 96% of the holdings being less than 10 ha. Private forest land is used mostly for the gathering of fuelwood and is therefore usually almost bare of trees or else carries stunted pines less than 3m high. Private forest land is also highly valued as a family burial ground but this traditional Confucian practice appears to be weakening.

2.09 Rice and barley are the major crops, accounting for two-thirds of the total crop area and they are grown throughout the country, with a concentration in the western and southern coastal areas (Maps 10378 and 10447). Due to climatic constraints, double cropping of rice is not possible in Korea but a rice-barley rotation is practiced in the southern regions and now occurs on about 45% of the total paddy land. With the advent of earlier-maturing varieties and improvements to management and infrastructure, double cropping is increasing and may eventually reach 60% of all paddy land (Annex 15). Rice yields in Korea are much higher than those in South and Southest Asia, reflecting a high level of input use and good management. However, yields are still 20% below those in Japan, indicating a margin for improvement. High-yielding varieties (HYV's) of rice were introduced in 1971 and

now account for 30% of paddy area. The Government's plans call for HYV coverage to reach 70% by 1980. The main constraints on national foodgrain production are water control (irrigation and drainage), varietal improvement (mainly of barley) and, to a lesser extent, agricultural credit.

2.10 The development of irrigation has played, and will continue to play, a major role in the expansion of rice production and the achievement of self-sufficiency (Annex 3). In 1962, the total irrigated area was 660,000 ha or 53% of the total paddy area. At present 1,100,000 ha, or 86% of all paddy area, is irrigated, though not all areas have fully adequate supplies. In recent years, emphasis has shifted from small-scale to large-scale irrigation projects but future planning, which calls for an additional 150,000 ha of irrigation by 1981, will stress both kinds of projects. The Government's plans also include 140,000 ha of drainage improvement, land consolidation for 290,000 ha and complementary development of inputs and farm mechanization.

2.11 Other food crops, soybeans and other pulses, potatoes and miscellaneous cereals, are grown mainly in upland areas and account for about 18% of the cropped area. Over the last decade, production of most of these crops has stagnated or declined, due to the conversion of upland to paddy (in response to a Government price policy which gives a strong incentive to rice production), partial abandonment of some poorly developed upland areas (Annex 4) and possibly other factors. Upland development on a wide scale is a fairly recent phenomenon in Korea and is a response to greatly intensified population pressure on the land resource since the Korean War. Most development on the lower slopes has been carried out by the farmers themselves. Government assistance on a large scale began in 1962 and 100,000 ha were developed in five years. Development then slackened and has accelerated only recently, following the passage of the Farmland Expansion and Development Promotion Law. A recent Government survey estimated that a further 200,000 ha of forest land could be economically converted to crop land, compared with an existing total upland area of 1.0 million ha. However, the remaining areas will present more severe technical problems than the past development did.

2.12 Fruit, vegetables, tobacco and ginseng are high-value crops, accounting for 11% of land area but almost one-quarter of crop value. Only small areas are used to grow maize and other feed crops. Livestock depend on crop residues, grazing of wastelands, rice bran and imported feeds. Cattle, which number 1.8 million, are kept mainly for draft purposes and one million families own one or more animals. Beef production is about 46,000 ton/yr and milk production over 100,000 ton/yr.

2.13 The Government has recently begun a national 10-year program to reforest 1.0 million ha of low productivity forest land (15% of all forest land). The purpose of this drive is to increase the production of timber, fuelwood, chestnuts and other forest products and to combat erosion, which has become a major problem on the steep, over-exploited hillsides. Within this program, fuelwood blocks will be established on 200,000 ha, to provide high-yielding, conveniently situated sources of fuel for the villagers, to ease the pressure on the remaining forest land and to reduce the

use of imported fuels and agricultural residues for heating. The relatively severe winters in Korea mean that an average rural household uses about 4.2 ton/yr of fuelwood for house heating (Annex 5). The rate of establishment of fuelwood blocks has now reached 40,000 ha per year.

2.14 The settlement pattern in Korea reflects topographic and historical realities. As 70% of the country is mountainous, settlements mostly occur in the valleys and coastal plains. Frequent wars and invasions have led to a pattern of clustered villages, each house having a courtyard and a single entrance gate. Korea has also undergone rapid urbanization in the last two decades, with Seoul and Busan now accounting for 23% of total population. These two cities exercise a strong influence on the surrounding regions, which are considerably more developed and urbanized than the nation as a whole. At the other end of the scale, one finds the remote settlements of the mountainous Northeast and the rugged coastal region of the Southwest characterized by smaller, more isolated and poorer villages. Nevertheless, while differences between rural regions are noticeable, the major disparity in living standards is between urban and rural areas.

2.15 Korea has a fairly well developed major transport network, with railways, expressways and paved two-lane highways connecting the provincial capitals and the major towns. The provincial and county road network is generally adequate in terms of density and location but much of it is badly surfaced and inadequately maintained, leading to excessive operating costs. Possibly more important, however, is the fact that many villages do not have vehicular access to the county road network, which sharply increases the costs of agricultural production, inhibits diversification into perishable crops and restricts the mobility of labor and the access of the villagers to social amenities. In 1969, a total of 46,000 km of village roads and 1,800 bridges were identified as being needed to give adequate access to all villages. Since then, 28,000 km of roads and 1,300 bridges have been constructed by volunteer labor (para 3.11). However, the remaining works are located in areas of more difficult topography or require longer bridges.

2.16 The average rural household income in Korea is now about US$1,300 per year and the resulting increase in living standards has created a demand for urban-type services, such as electricity, water supply, postal services and access to telephones (in approximately that order). The Government has recognized that services of this kind are important in discouraging rural-urban drift (which has been as strong in Korea as elsewhere in Asia, though perhaps with less damaging consequences due to industry's ability to absorb labor) and has responded with a massive program of rural electrification and more modest programs for the other services. Electricity is now available to nearly 60% of rural households, compared to 93% in the cities, and the Government plans to increase the rural coverage to about 90% by 1978. Initially, village electricity is used mainly for lighting, radio and television sets and domestic appliances but, in the longer term, it does set the stage for the development of cottage industries and other small-scale productive enterprises.

2.17 The water supply program is less well advanced. Since 1971, the proportion of the rural population served by simple piped water systems with

individual house connections has doubled to reach 25%. The Government hopes to increase this by another 4,000 systems (12%) in the next few years and to reach 50% coverage by 1981. The objective of the program is to provide a safe, convenient and reliable supply of water to each house compound, replacing wells of limited capacity and reliability. Water supply is well advanced in the cities and larger towns but the rural centers of 1,000 to 20,000 population have lagged seriously behind.

Previous Bank Group Investments

2.18 While this project would be the first multi-sectoral Bank-assisted project for rural development in Korea, it draws on experience gained in several previous Bank Group investments. Technical standards for irrigation have been developed under the Pyongtaek-Kumgang (Loan 600-KO) and Yong San Gang (Loan 795/Credit 283-KO) Irrigation Projects, which cover 30,000 ha and 33,000 ha, respectively, on the West Coast. A Seeds Project (Loan 942-KO) is assisting the expansion of seed production for most of the major food crops. A Dairy Development Project (Credit 234-KO) is assisting small-scale milk producers and establishing processing plants and a second similar project has been approved. Specialized cash crops, such as orchards, sericulture, asparagus and mushrooms, are being developed under an Agricultural Credit Project (Credit 335-KO) and an Agricultural Processing Project (Loan 994-KO). Agricultural Education is being assisted by the Second and Third Education Projects (Loan 906/Credit 394-KO and Loan 1096-KO). Bank Group investments in the transport sector include five Railways Projects and three projects for the major highway network. Other external finance for rural development has come from ADB (irrigation and rural electrification) and USAID (community development, irrigation, upland development and power).

2.19 In addition to project financing, the Bank has carried out, in the last few years, the following Sector Surveys: Agriculture; Transportation; Power; and Water Supply. These surveys give additional information on the sectoral setting of each of the components of the proposed project.

III. THE SAEMAEUL MOVEMENT

Origins and Goals

3.01 The proposed project would fit within the framework of the Saemaeul Movement, launched in September, 1971 as part of a large-scale effort to reduce the rural-urban income gap and to slow down rural-urban migration (Annex 2). The new program has drawn upon USAID-financed community development experience during the late 1950's and the early 1960's, but it is considerably broader in scope and more ambitious in its goals. The following discussion is intended to give only an overview of the Saemaeul Movement. In-depth analysis is restricted to those sectors to be assisted under the project.

3.02 The Saemaeul Movement is a multi-objective approach to rural development. Its fundamental goals are to increase the incomes of farm households, to improve living conditions in the countryside and to build self-reliance at

the village level. The many activities undertaken to achieve these goals can be classified as follows:

(a) environmental and housing improvements - for example, roof improvements, drains, kitchen improvement, community halls, and communal laundries;

(b) infrastructure - for example, rural roads, bridges, minor irrigation systems, water supply, and electrification; and

(c) income-generating or directly productive activities in agriculture and manufacturing - for example, livestock raising, silk production, and cottage industries.

3.03 Besides providing physical infrastructure and employment opportunities, the Saemaeul Movement puts a heavy emphasis on institution building. The main goal is to develop self-reliance, that is, the capacity of villagers to program, finance, and execute a range of developmental activities with a minimum of outside assistance. Another social development objective is the modernization of attitudes in the rural areas, for example, the promotion of a commercial rather than a subsistence view of agriculture. The emphasis on self-reliance is reflected in the following (rather qualitative) classification of villages, used to determine the degree of Government assistance:

(a) Basic villages - These lack leadership as well as the technical and financial resources necessary to carry out development projects and therefore require guidance, as well as financial assistance, from the Government;

(b) Self-help villages - These have acquired the necessary leadership and organizational ability to identify and carry out development projects but lack the financial resources to implement them and therefore still require Government financial support; and

(c) Self-reliant villages - These have carried out a number of projects and achieved a degree of financial self-sufficiency, allowing them to finance development from their own resources or from loans.

3.04 In 1973, basic villages represented 53% of the total number of villages in Korea (18,900 out of 34,700), and self-reliant villages 7%. Government plans call for the elimination of the basic village category in 1976 and for achieving self-reliance for all villages by 1981 (Annex 2, Table 1). This target, which implies a reduction in direct subsidy support (paras 5.11 and 5.12) over the next few years, appears reasonable and attainable, though the target will perhaps not be reached as quickly as the Government would like.

3.05 While there are regional variations of income in Korea, these are relatively small and there are no clearly defined large depressed areas.

Reasons for this include the compact size of Korea, the well developed communications network, the mobility of the labor force, the high rate of literacy throughout the country and the equitable farm size distribution (para 2.07). There is no sharp distinction between subsistence and commercial agriculture and, as a result, new techniques and attitudes have diffused fairly quickly. Nevertheless, there are many small localities, scattered throughout Korea, where poor transport and lack of services such as irrigation, electricity and water supply are constraining development and encouraging rural-urban migration. For these reasons, the Saemaeul Movement is nationwide but concentrates on the basic villages, which tend to be in the more remote parts of each region. For the same reasons, the proposed project would also be national in scope with an emphasis on basic (and also self-help) villages.

Organization of Saemaeul Activities

3.06 The organizational structure of the Saemaeul Movement has two main characteristics:

(a) Within the government, Saemaeul activities are administered by the existing government agencies and are subject to the existing technical review and budgetary approval procedures. The arrangement does create a problem of adapting agency priorities to development needs as perceived by the villagers but, on the other hand, it ensures the integration of Saemaeul activities into the established government programs and operating procedures.

(b) Within the villages, the Saemaeul Movement attempts to build new institutions and to train a new generation of village leaders.

3.07 At the national level, general policy issues for the Saemaeul Movement are dealt with by a Vice-Ministerial Coordinating Committee, chaired by the Minister of Home Affairs and with representation from all ministries dealing with Saemaeul activities. A Central Coordinating Committee of senior officials then translates these general policy objectives into sectoral planning guidelines for the Ministries. At the Provincial level, responsibility for Saemaeul planning is assumed by a Provincial Coordinating Committee. There are also county and district Saemaeul Committees, comprising representatives from all the Government agencies concerned.

3.08 At the village level, Saemaeul Committees, headed by an elected Saemaeul leader and assisted by a woman leader, have been established. In most villages, the Saemaeul leader is not the village chief, who is appointed directly by the Provincial government, but is a younger man with above-average education or skills. The establishment of a Saemaeul program for a village and the selection of projects is an iterative process in which an initial proposal, drawn up by the village Saemaeul Committee, is submitted to the district committee then to the county committee. These committees allocate funds on the basis of: (a) sectoral priorities defined by the

Government; (b) the technical feasibility of the project; and (c) the village's past record of achievement and the suitability of the proposed project for the stage of development of the village.

3.09 There are no hard and fast rules as to the type and mix of projects to be undertaken by each category of villages but the general pattern is that basic villages undertake mainly environmental improvement activities, which provide a testing ground for training the new leadership and for building a sense of community. Self-help villages concentrate mainly on infrastructural projects, which include a Government subsidy, and self-reliant villages undertake directly productive projects, usually financed by credit, with little (if any) subsidy element.

Achievements of the Saemaeul Movement

3.10 By now, "Saemaeul" has become almost synonymous with rural (and, in some cases, urban) development. Thus the movement has no firm boundaries and the exact determination of the total investment in and the physical achievements of the Saemaeul Movement is difficult. Available data are summarized in Annex 2, Tables 2 and 3. According to official figures, a total of Won 275 billion (approximately US$567 million) was invested in Saemaeul projects between October, 1971 and May, 1974, with Won 102 billion in 1974 alone. It is worth noting that only 22% of the total investment was provided from government budgets. The remaining 78% was contributed by the villagers, mainly in volunteer labor, which totalled 215 million man-days. For the present project, which stresses infrastructural programs, the Government contribution would be higher, about 50%. A sample survey conducted in 30 villages by the Korea Development Institute showed that an average rural household contributed 39 man-days to Saemaeul activities during the above 32-month period. The labor contribution increased with the stage of development of the village--a basic village contributed only 21 man-days on average during the period, while a self-reliant village contributed 58 man-days (Annex 2).

3.11 The physical achievements of the Saemaeul Movement up to 1974 include 28,000 km of village roads, 9,800 village water supply projects, 48,000 ha of land consolidation, and 52,000 ha of reforestation (including fuelwood blocks). The movement covers practically all the villages of Korea. It is worth stressing that physical construction is only one objective of the Saemaeul Movement--institution building and the development of self-reliance (para 3.03) are equally important, though more difficult to measure.

Project Formulation

3.12 Bank assistance for rural development in Korea has been under discussion for some years between the Government and the Bank. The major challenge has been to formulate a project in which the policies, administrative procedures and appraisal standards of the Bank could be met within the Government's multi-sectoral, decentralized and evolving approach to rural development. In early 1975, the Government proposed to the Bank a package of seven sectoral programs of the infrastructure type for Bank assistance.

These sectors were chosen because of their high priority within the Government's development planning, the Bank's familiarity and expertise in these sectors and their preponderant economic benefits. The proposed components all represent high-priority rural development needs and would have been considered for financing even in the absence of the Saemaeul Movement. One component (River Improvements) could not be prepared in time for inclusion in the project. In the detailed formulation and appraisal of the project, every effort has been made to work through the existing administrative procedures wherever possible, to support self-help and institution-building at the village level, and to use conventional Bank procedures in a flexible way to accommodate a unique project.

3.13 The proposed project includes six infrastructural investment programs, most of which have direct economic benefits. However, water supply (and, to a lesser extent, rural electrification) is justified largely as a means of improving the quality of village life. The project would mainly assist villages in the "self-help" category, although the fuelwood and rural electrification components would be directed more at "basic" villages, as the more advanced villages have already benefitted from these programs. The degree of self-help would vary between the components but it would be present in all cases, either in the form of volunteer labor, a cash contribution or a loan repayment obligation.

3.14 The Bank's involvement in the Rural Infrastructure Project would contribute to:

(a) an acceleration of the pace of development in some rural sectors and the maintenance of the recent rapid rates in other sectors;

(b) the introduction of quantitative sub-project selection criteria;

(c) improvement of the technical design and execution standards of sub-projects; and

(d) the development of planning and programming capability for rural development (through the provisions for project monitoring and evaluation).

IV. THE PROJECT

4.01 The proposed project would support on-going Government programs in minor irrigation, upland reclamation, fuelwood, roads and bridges, water supply and rural electrification. The project also provides for training, technical assistance, improvement of hydrologic services and for monitoring and evaluation of the results of the investment program. The works to be constructed under the project are described in Annexes 3 to 8 and are summarized below:

Project Works

4.02 Minor Irrigation - This component (Annex 3) would consist of 66 sub-projects, serving an area of 13,500 ha in all Provinces of Korea (except Jeju Island) and benefitting about 400 villages. The service areas include rainfed paddy lands and some upland areas to be converted to paddy. About 65% of the sub-projects would use small earth dams, less than 30 m high, similar to many which have been successfully constructed in Korea in the past. These dams typically have ungated overflow spillways on one abutment and a pipe outlet, controlled by a slide gate, for releasing irrigation water. The remaining sub-projects would use pumping stations or weirs, in areas where perennial river flows are available. The sub-project works include the main canals and rough levelling of upland areas to be converted to paddies, along with on-farm development works (minor ditches and drains and final land levelling), which would be carried out by the farmers concerned. There is ample evidence in Korea that farmers are willing to undertake this work. In order to ensure rapid implementation of the component, land consolidation or boundary realignment has been left for future consideration.

4.03 Upland Reclamation - Upland reclamation (Annex 4) refers to the conversion of presently unproductive sloping lands (most of which at present carry a light cover of small trees and grass and yield only fuelwood) to cultivable land. The method of treatment would depend on the slope (which varies from 5 to 35%), depth and type of soil, agronomic potential and other factors. As the upland areas remaining to be developed are more difficult than those developed to date, past design and construction procedures will need to be modified. The upland reclamation component is thus envisaged somewhat as a pilot project, with a strong technical assistance and research element. About 55% of the land to be reclaimed would be reshaped into a series of near-level benches with full protection of banks and drainage ways to prevent erosion. Other designs (semi-bench terracing and contour farming) would be used only under favorable conditions. The upland reclamation component would include about 35 sub-projects benefitting about 100 villages, or a total net development area of 4,500 ha, in most Provinces of Korea but concentrated in the more densely populated Western Provinces. After conversion, these lands would grow a variety of upland crops, including barley, soybeans, fruits and vegetables.

4.04 Fuelwood - The project would have a significant impact on Korea's shortage of fuel (para 2.13) by establishing about 11,000 village fuelwood blocks, covering about 127,000 ha (Annex 5). Sub-projects would vary from 3 to 50 ha in size, the smaller blocks being additions to previous fuelwood developments. Sub-projects would cover all Provinces but would be concentrated in the more densely populated Provinces, where fuel shortages are most severe. The fuelwood component would follow the procedures developed under the large and successful program carried out in the last few years. Plantations would be established mostly on private "forest" land of low productivity (the owner being entitled to 10% of production) by communal labor, with seedlings, fertilizer and technical assistance being provided by government agencies. The main species used are Pine, Black Locust, Alder and Lespedeza, and blocks would typically contain a mixture of fuelwood and timber-producing species. The proportion of timber species would not exceed

35% under the project. The project includes support for fuelwood research, in the form of vehicles, equipment and materials. This research would address problems such as species selection, optimum spacing and fertilizer use.

4.05 Roads and Bridges - Approximately 850 km of farm and village roads, as well as 200 bridges, would be constructed under the project (Annex 6). This component would benefit about 900 villages. Road segments would average about 3 km and would generally follow the alignments of existing footpaths and tracks. Roads would be about 5 m in width and would have a graded surface of stone or gravel. Bridges would generally be 4 m wide and of simple reinforced concrete slab (or beam and slab) construction, multiple spans being used when necessary. Under the project, greater attention than at present would be given to the design of foundations and to the quality of concrete used. Communal labor would be used for the construction of roads and bridges, with cement, reinforcing steel, tools and certain types of skilled labor being provided by the government. The provision, under the project, of some simple equipment, such as concrete mixers and stone crushers, would be necessary to improve the quality of construction to acceptable levels.

4.06 Water Supply - Sanitary water supplies would be constructed in about 2,000 villages in all Provinces (Annex 7). Dug wells are the usual sources of water, although springs, infiltration galleries and surface sources (with a pressure filter and chlorinator) are also used. Water is pumped to a storage tank, from which a distribution system (usually of PVC pipe) serves each house compound. A per capita consumption of 80 l/day is allowed for in design. Standards of design, construction and operation are sufficient to ensure economy and bacteriological safety. The works would be constructed by communal labor, with materials and certain types of skilled labor supplied by the government. Concrete mixers, provided to the counties under the roads and bridges program, would also be available to water supply sub-projects, to increase the likelihood that storage tanks would be watertight.

4.07 Rural Electrification - This component (Annex 8) would electrify 305,000 additional rural households, through a program of 2,682 sub-projects serving 6,075 villages. A typical village would be supplied by extending a single- or three-phase branch from an existing primary feeder. Each house compound would be given a 10A metered service at 220 V. Concrete poles would be used, with aluminum conductors (steel reinforced) in most of the country and copper in some areas with corrosion problems. Individual householders would engage electricians for house wiring. The systems would be designed primarily for lighting, radio and television sets and light commercial loads.

Improvement of Hydrologic Services

4.08 Korea has a reasonably good network of rainfall and streamflow gauges and has made commendable efforts in publishing hydrologic measurements. The major deficiency has been in analyzing the available data so as to develop efficient and reliable design methods for the water development design agencies. Under the project, the Ministry of Construction (and other agencies), with consultant assistance (para 5.08), would apply modern

techniques to some of the more urgent problems, such as reservoir sizing, spillway capacity determination and rates of sedimentation. These methods would be incorporated into handbooks to be used, for example, in designing future minor irrigation sub-projects. The project would also provide for additional gauging and other equipment and includes a concerted effort to obtain rating curves for the existing streamflow gauges.

Project Planning and Sub-Project Selection

4.09 Sub-project selection involves both the villages and the government agencies. For village-specific sub-projects, each village sets its own priorities, subject to the review of the County Saemaeul Committee (para 3.08). For larger-scale projects, such as irrigation and upland development, the government agencies have the major role in identifying and evaluating potential sub-projects, though local pressure is also important in determining priorities. For the present project, technical and economic sub-project selection criteria have been reviewed and, in most cases, improved. Sub-project selection has been largely completed and a master list of sub-projects was agreed upon at negotiations for most components. Some amendments are being made to the roads and bridges and water supply sub-project lists and final agreement is expected in February, 1976. For upland reclamation, it has been decided to defer the finalization of a master list until the upland reclamation adviser has been engaged (para 5.07). For minor irrigation, a list of potential sub-projects was reviewed first on technical grounds (mainly to ensure an adequate water supply) and then a cutoff economic rate of return (10%) was applied to select a program of works within the available budget. Upland reclamation components will be selected so as to maximize their economic and financial rates of return, while maintaining a reasonable geographical balance, to allow the proposed design methods to be tested under a variety of soil and topographic conditions. Criteria used include the potential for high-value crops, accessibility and farm size (to avoid labor constraints). Fuelwood sub-projects have been selected mainly on the size of the estimated fuel deficit in the village, following a nationwide survey in 1975. Quantitative selection criteria for roads and bridges have been introduced for the first time. Factors considered include road length and farmland served, which can be shown to be related to the economic rate of return (Annex 20). Water supply selection criteria include the state of the present water supply, the incidence of waterborne diseases and the unit cost of improving the supply. Criteria for selecting rural electrification sub-projects include population density and the proximity of an existing feeder line. In all the components, in addition to the above technical and economic criteria, the village's past record of achievement under the Saemaeul Movement and its willingness to contribute to the proposed sub-project are also taken into account.

Status of Design

4.10 For the minor irrigation component, designs are now completed for 80% of the program. All designs were completed by the end of January 1976. For upland reclamation, detailed designs would be prepared only after the ground had been cleared and detailed topographic and soil surveys made. There

should be no difficulty in preparing designs in pace with construction. For fuelwood, the design work is minimal and there would be no problems in completing it before March, 1976. For roads, final designs are available for about 25% of the total program. All designs for each year's program would be completed by March of that year. Design work in water supply has reached only 1% of the program but local consultants will be used to expedite the work. For rural electrification, about 7% of the sub-projects have been designed. Except for upland reclamation, current design standards are satisfactory and final designs would not be submitted individually to the Bank. As the existing standards for the design and construction supervision of upland reclamation sub-projects are not suitable (Annex 4), agreement was reached at negotiations on appropriate standards (similar to those described in Reference 1) and an assurance obtained that the agreed standards would be employed throughout the implementation of this component (Section 3.04 of the Loan Agreement and Supplemental Letter).

Construction Methods

4.11 Labor-intensive methods would be used for those components to be constructed by village volunteer labor, namely, fuelwood, roads and bridges, and water supply. As there is a serious need to improve the quality of structural concrete for these components (now produced by hand mixing), small hand- or gasoline-powered concrete mixers would be procured under the project and assigned to the county offices. The other components (minor irrigation, upland reclamation and rural electrification) would be executed by contract, the intensity of machine use varying with the size and nature of the work. In some cases, equipment would be rented by the government agencies to civil works contractors. Cement and reinforcing steel would be supplied to the contractors by the Government.

Construction Schedule

4.12 As the project is by nature a time slice of an on-going program the duration of the project is, to some extent, arbitrary. In general, a two-year period (1976-77) has been used, based on an assessment of the likely speed of execution for the agency concerned. The rural electrification component and the bridges program would be substantially completed in 1976. A small proportion of the minor irrigation and upland development sub-projects would run into 1978, while technical assistance in hydrology, the research programs in upland reclamation and fuelwood, and the project monitoring and evaluation program would continue through 1978.

Cost Estimates

4.13 Total project costs are estimated at US$143.5 million, of which US$60.0 million (42%) would be foreign exchange. The cost estimate is based on recent experience with similar work by the agencies concerned, unit costs being updated to projected January, 1976 levels. No physical contingencies are included, owing to the nature of the project. Any rise or fall in quantities or unit prices (apart from the effects of inflation) would be compensated by a decrease or increase in the number of sub-projects included in

the component. Provision has been made for expected price increases of 15% in 1976 and 10% per annum thereafter. While inflation in Korea in recent years has been above these levels, it is anticipated that it will moderate in the future and that, in any case, continued rapid inflation would lead to further exchange rate adjustments and thus limit cost increases, expressed in US Dollars, to about the levels used. Price contingencies amount to US$17.4 million or 14% of the baseline estimate.

4.14 A detailed cost estimate is given in Annex 10 and is summarized below:

Item	Local	Foreign	Total	Local	Foreign	Total	Foreign Exchange Component (%)	% of Total
	------Won billion----			-----US$ million-----				
Minor Irrigation	15.1	10.2	25.3	31.3	20.9	52.2	40	41
Upland Reclamation	2.6	1.7	4.4	5.4	3.6	9.0	40	7
Fuelwood	6.5	0.3	6.8	13.3	0.7	14.0	5	11
Roads and Bridges	2.1	1.2	3.3	4.3	2.5	6.8	37	6
Water Supply	2.2	1.5	3.6	4.5	3.0	7.5	40	6
Rural Electrification	6.9	10.4	17.3	14.2	21.4	35.6	60	28
Other Services	0.3	0.2	0.5	0.6	0.4	1.0	40	1
Base Cost Estimate	35.7	25.5	61.2	73.6	52.5	126.1	42	100
Price Contingency	4.8	3.6	8.4	9.9	7.5	17.4	43	
Total Project Cost	40.5	29.1	69.6	83.5	60.0	143.5	42	

The above costs represent financial outlays only and do not include the value of volunteer labor. The opportunity cost of such labor is discussed in para 6.04.

Financing

4.15 The proposed Bank Loans totalling US$60.0 million would finance the foreign exchange requirement of the project. However, the disbursement rates for the various components (para 4.20) would vary from the estimated foreign exchange requirement, in order for the Bank to make a reasonable contribution to each component. As the Korea Electric Company (KECO) is an autonomous public corporation, a Project Agreement and a Subsidiary Loan Agreement would provide for the on-lending of US$18.1 million through the Korea Development Bank (KDB) to KECO for the rural electrification component on the same terms as Government funds on-lent to KECO through KDB, namely 7.5% interest with repayment of 35 years, including a five-year grace period. A proposed

condition of disbursement for the rural electrification component would be that a Subsidiary Loan Agreement, acceptable to the Bank, had been concluded between KDB and KECO. Sources of funds for the project would be as follows: National Government 94% (US$134.4 million), of which US$57.4 million would be loaned to the beneficiaries; Provincial Governments 6% (US$9.1 million). In addition, the beneficiaries would contribute labor with a nominal value of US$24.8 million. Details of the financing arrangements for each component are given in Annex 14.

4.16 Bank disbursements (para 4.20) would be mainly used to reimburse expenditures from the national budget (for the minor irrigation, upland reclamation, fuelwood and water supply components), the Provincial budgets (roads and bridges), or would be on-lent to the executing agency in the case of rural electrification (para 4.15). For roads and bridges, National government funds would be provided to the Provinces under general revenue-sharing arrangements. Government loans for the minor irrigation and upland reclamation components (US$18.4 million) would be made to the executing agencies through the National Agricultural Cooperative Federation (NACF), while Government loans for rural electrification (US$13.1 million) would be made to KECO through KDB. The terms and conditions of loans to the beneficiaries are discussed in paras 5.11 and 5.12 and in Annex 14. Local currency costs would be financed through annual budgetary appropriations to the various implementing agencies, including the Provincial and county governments.

4.17 An assurance has been obtained that the funds required to carry out each year's work program would be allocated annually in the regular National and Provincial budgets (Section 3.01 of the Loan Agreement). Because of the proposed disbursement procedures (para 4.20), the Government would need to have sufficient funds on hand at the beginning of each quarter to finance the whole project cost during that quarter. Availability of funds for 1976 was confirmed at negotiations.

Procurement

4.18 Equipment and Materials - Equipment and materials are listed in Annex 11. Except for materials to be procured through local shopping (see below), the requirements for equipment and materials for each year's program would be consolidated by the executing agency (Chapter V) and forwarded to the Office of Supply of the Republic of Korea (OSROK). OSROK would further consolidate the lists, where feasible, and would procure the goods. Cement; reinforcing steel; PVC pipes; small pumps; electrical conductors, insulators, transformers and switchgear; and field vehicles and motorcycles (estimated to cost US$23 million) would be subject to international competitive bidding (ICB), in accordance with the Bank Group Guidelines. A preference of 15% of the cif price of imported goods, or the prevailing customs duty if lower, would be extended to local manufacturers. Other goods (estimated to cost about US$14 million) would be subject to local competitive bidding (LCB) procedures acceptable to the Bank, as either the quantities required are small or the nature of the supplies is such (for example, concrete poles, metal brackets) that there would be no interest from foreign manufacturers.

The above ICB and LCB procedures would not apply for materials required for roads, bridges and water supply sub-projects scheduled for construction before June 30, 1976 and for all cement and steel required for these components. In order that a whole construction season might not be lost due to procurement delays, such materials (listed in Annex 11) could be purchased by the county governments under local shopping procedures acceptable to the Bank with ceiling unit prices set by the Government, based on recent bidding results for bulk procurement. Such procurement would be limited to US$10,000 per contract or US$9.0 million in the aggregate. An assurance has been obtained that OSROK would submit to the Bank, through the EPB, periodic reports on the procurement of materials, including lists of bids received on all contracts, and that, for materials and equipment subject to LCB, if OSROK intends to award a contract to other than the lowest evaluated bidder, a detailed evaluation report would be forwarded to the Bank before the award is made (Section 3.09 and Schedule 4 to the Loan Agreement). Supplies of transplants and fertilizer for the fuelwood component (estimated to cost about US$10 million) would need to be procured close to the planting sites. Transplants would be procured from local government or private nurseries, after obtaining several quotations, while the small amounts of fertilizer required would be obtained from NACF's bulk supplies. Further details are given in Annex 11.

4.19 Civil Works - Because the 15,000 or so sub-projects are individually quite small and scattered over the whole country, it would not be feasible to combine them in packages large enough to be of interest to international contractors. The largest of the sub-projects (for minor irrigation) would generally be less than US$2.0 million and are thus relatively small in international terms. Experience on the two ongoing irrigation projects (para 2.18) has shown that foreign contractors are not willing to bid on even considerably larger works of this kind in Korea. The project civil works would therefore be constructed either by small, locally-advertised contracts (Minor Irrigation, Upland Reclamation and Electrification) or by volunteer labor (Fuelwood, Roads and Bridges and Water Supply). Standard forms of contract for the minor irrigation and upland reclamation components have been reviewed and are acceptable to the Bank, provided bids are normally awarded to the lowest evaluated bidder. An assurance has been obtained that, for the minor irrigation and upland reclamation components, local bidding procedures acceptable to the Bank would be followed; a full list of bidders, together with the amounts of their bids and a brief bid evaluation, would be forwarded to the Bank for all contracts exceeding US$1.0 million; and that, if the Government intends to award a contract to other than the lowest evaluated bidder, a detailed evaluation report would be forwarded to the Bank before the award is made (Schedule 4 to the Loan Agreement). There would be about 15 contracts exceeding US$1.0 million.

Disbursements

4.20 Procedures for preparing disbursement applications are discussed in para 5.15. Disbursements for materials, vehicles and equipment procured following ICB would be made at 100% of the cif cost or 100% of the ex-factory cost, if manufactured locally (30% for water supply materials).

Disbursements for materials procured following LCB and local shopping would not be made directly but would be included with disbursements for civil works (including plantation establishment), which would be made at the following standard percentages of certified actual cost (including the cost of locally-procured materials), as construction proceeds: minor irrigation 30%; upland reclamation 40%; fuelwood 30%; roads and bridges 36%; water supply 30%; and rural electrification 25% (Annex 12, Table 2). Disbursements for foreign training and consultant and advisory services would be at the rate of 100% of foreign costs. Disbursements for project evaluation would be at the rate of 50% of the certified actual cost of studies carried out by non-government and semi-government bodies. There would be no disbursements for project monitoring, local training or volunteer village labor. The estimated schedule of expenditures on the project, the proposed allocation of the proceeds of the Loans, and a quarterly disbursement schedule are presented in Annex 12. Any savings in the Loan accounts would, at the request of the Government, be used to finance additional sub-projects of the type included in the project. It is expected that disbursements would be completed by June 30, 1979, about one year after the completion of the bulk of project construction.

Accounts and Audits

4.21 The progress of the project would be recorded through a series of quarterly reports (para 5.15) from the executing agencies. As these agencies are all Government departments or regulated corporations they would be subject to normal Government control and supervision procedures. Each Ministry has an internal auditing section, to examine its accounts, as well as those of lower levels of government and corporations supervised by the Ministry. The Ministerial auditing sections are supervised by the Board of Audit and Inspection, an independent agency reporting directly to the President. The Board's methods include routine audits (formal audits), which may be waived if the Board is satisfied with the agencies' internal auditing procedures, and comprehensive audits (performance audits), in the case of large projects or where wrongdoing is suspected. These arrangements would be satisfactory for the financial auditing of project expenditures. An assurance has been obtained that each executing agency would maintain a separate project account, that these accounts would be audited annually, initially by the auditing section of the responsible Ministry and ultimately by independent auditors acceptable to the Bank, and that these auditors would submit to the Bank, within five months of the close of a fiscal year, an audit report on the project accounts, in such detail as the Bank may request (Section 4.03 of the Loan Agreement). It has been agreed that the Board of Audit is acceptable to the Bank for this purpose (Supplementary Letter).

4.22 The rural electrification component would be executed by the Korea Electric Company (KECO), a public utility owned 50% by the Government and operated along commercial lines (para 5.06). An assurance has been obtained that KECO would engage an independent auditor, acceptable to the Bank, and would submit to the Bank, within four months of the close of each fiscal

year, its audited balance sheet and financial statements for the year (Section 4.02 of the Project Agreement).

4.23 In order that the Government and the Bank might be sure that the funds expended under the project were being used only for the purposes of the project, some spot checking of physical progress would be required. A master list of sub-projects to be included in the project was agreed upon at negotitiations, for most components. The list will be finalized before March, 1976. During project execution, other sub-projects could be substituted but only with the agreement of the Bank. At the end of each quarter, the Ministry responsible for each component would select not less than ten sub-projects at random and visit the sites, in order to verify the reports of the executing agency with respect to these sub-projects. It should be noted that the executing agency is either a local government (Province or county) or an autonomous body (such as KECO) and thus a Ministry check would be reasonably independent. An assurance has been obtained that the quarterly reports of the executing agencies, forwarded to EPB through the Ministries (para 5.15), would be accompanied by a statement as to which sub-projects had been visited, the results of the visits and follow-up action taken (Section 3.09 of the Loan Agreement).

Supervision

4.24 Owing to the large number of sub-projects, systematic supervision of each sub-project by Bank staff would be impossible. Even so, the project would require a greater than normal supervision input. As the interests of the Bank and the Government in speedy and efficient execution of the project coincide, it would be possible for the Government, through the monitoring arrangements of para 5.15 and the auditing procedures outlined above, to undertake the bulk of the necessary supervision work. Bank supervision missions would then be free to concentrate on the overall progress of the project, technical problems, the evaluation of project benefits and so on. These missions would also make spot checks on randomly selected sub-projects.

Project Initiation Plan

4.25 The major steps to be undertaken before project construction can begin are: completion of sub-project selection and designs (para 4.10); procurement of materials (which process has already been started); execution of a Subsidiary Loan Agreement (for the rural electrification component); appointment of a technical adviser (for the upland reclamation component) and a consulting firm (for the hydrologic studies). Critical dates for these and some other less important steps are given in Annex 13.

Environmental Effects

4.26 The expected environmental effects of each component of the project are discussed in Annexes 3 to 8. No major problems are anticipated. Increased soil erosion from the construction of irrigation, upland development or roads sub-projects would be minimized by careful design and construction supervision. The establishment of fuelwood plantations would reduce erosion

from overused upland areas. The water supply component would increase the supply of safe water in Korea's villages and thus improve the general level of public health.

V. ORGANIZATION AND MANAGEMENT

Project Execution

5.01 The various infrastructure components of the project are parts of ongoing programs, which are the responsibilities of several ministries. This division of responsibility would not be changed for the execution of the project but existing provisions for supervising the standards of work and for monitoring and evaluating the effectiveness of the project would be strengthened. The executing agencies for the various components are described below.

5.02 Minor Irrigation and Upland Reclamation. Overall responsibility for these components rests with the Farmland Bureau of the Ministry of Agriculture and Fisheries (MAF), which is also responsible for project planning and sub-project selection. Minor irrigation sub-projects would be owned and operated by the Farmland Improvement Associations (FLIA's), of which 127 exist at present in Korea, covering all the major agricultural areas. While the FLIA's are formally voluntary associations of farmers, they are under close supervision by the Provincial administrations, which appoint the FLIA chairmen, and indirectly by the MAF. The role of the FLIA's in operation and maintenance and agricultural supporting services will be described in paras 5.10 and 5.20. Technical services for sub-project design and construction supervision would be provided by the Agricultural Development Corporation (ADC), a semi-autonomous corporation supervised by MAF, having broad responsibilities for land and water development throughout Korea. ADC has a staff of 1,200 engineers and technicians, managed by a President, a Vice-President and a Board of Directors. Minor irrigation sub-projects would be designed by ADC's Survey and Design Department and construction would be supervised by the ADC Branch (Provincial) Office concerned, on behalf of the FLIA (Annex 3, Figure 3). Construction of upland reclamation sub-projects would be administered by the county governments, with technical services provided by ADC, through its newly-created Farmland Expansion and Development Corps.

5.03 Fuelwood. The fuelwood component would be administered by the Ministry of Home Affairs (MHA), through the Office of Forestry, and executed by the Village Forestry Associations (VFA's), which have been established in every village. The VFA's are structured like cooperatives and are grouped into VFA Unions at district and county levels and a Federation of VFA Unions at the national level. The VFA structure is closely supervised, administratively and technically, by the Office of Forestry and its branches in the Provincial, county and district administrations (Annex 5, Figure 1). Fuelwood sub-projects would be planned and supervised, both at establishment and in operation, by the county foresters of the VFA Unions and the district

staff of the Office of Forestry. Most fuelwood plantations would be established on private land, made available to the VFA under a long-term lease (Annex 5). Production of fuelwood would be shared amongst the VFA members in proportion to the amounts of volunteer labor contributed, with 10% of the total going to the landowner as rent. The equipment for fuelwood research included in the project would be used by the Forest Research Institute, under the Office of Forestry.

5.04 Roads and Bridges. Responsibility for the planning and overall administration for this component lies with the Saemaeul Guidance Division of the MHA. Overall administration and supervision of sub-projects would rest with the Saemaeul Guidance Sections at the Provincial level (for bridges) or the county level (for roads). Under the project, the roles of the Provincial Construction Bureaus and County Construction Divisions in the technical supervision of the construction of bridges and roads respectively would be strengthened through deployment of additional staff to overcome present deficiencies in the quality of completed work (Annex 6). An agreement to this effect was reached at negotiations.

5.05 Water Supply. The Ministry of Health and Social Affairs would be responsible for the water supply component, through its Environmental Health Bureau (Annex 7). The preliminary design of individual sub-projects would be the responsibility of sanitarians in the county administrations. The county Construction Division would then undertake detailed design and supervision of construction, which would be carried out by village labor. Design and construction would be subject to review by an engineer in the Public Health Section of the Provincial administration.

5.06 Rural Electrification. The Ministry of Commerce and Industry (MCI) would be responsible for the overall planning of the rural electrification component, with the Provincial governments being responsible for sub-project selection and coordination with other rural development activities (Annex 8). The executing agency for sub-project design and construction would be the Korea Electric Company (KECO), an autonomous public corporation, which is responsible for nearly all power generation, transmission and sales in Korea. Construction would be supervised by KECO's branch offices.

Technical Assistance

5.07 In order to establish the new design and construction standards for upland reclamation (para 4.10) and to test them under various topographic and soil conditions, the services of an adviser with broad international experience in soil conservation would be required. As well as advising the Director of the Farmland Expansion Corps of ADC on the proper design and execution of the project works, the adviser would also establish and supervise a program to measure runoff and soil losses for different types of upland development and incorporate the findings of such research into revised design standards. He would also make recommendations on staff training and liaise with the Office of Rural Development on the establishment of follow-up extension efforts with the farmers in reclaimed areas. An assurance has been obtained that ADC would employ, within four months of Loan signing, an

adviser with qualifications and experience acceptable to the Bank, for a two-year period (Section 3.04 of the Loan Agreement).

5.08 The Division of Water Control, Bureau of Water Resources, Ministry of Construction (MOC) would be responsible for the Improvements to Hydrologic Services included in the project (para 4.08), under the overall guidance of a Steering Committee on which the major user agencies for hydrologic information (for example, ADC) would be represented. Further details are given in Annex 9. An assurance has been obtained that a Steering Committee for Hydrologic Services would be established within six months of Loan signing (Section 3.02 of the Loan Agreement). An international consulting firm specialized in hydrology would be engaged to assist MOC in designing improvements to the existing gauging network, advising on the procurement of equipment and the publication of data and undertaking studies aimed at overcoming the shortcomings of the analytical methods in use at present in Korea. These studies would lead to the production of revised design handbooks for MOC, ADC and other users. About 35 man-months of consulting assistance would be required. Outline terms of reference are given in Annex 9. An assurance has been obtained that MOC would employ, within six months of Loan signing, a consulting firm specialized in hydrologic analysis (or a consortium of firms, one of which is specialized in hydrology) acceptable to the Bank, under terms and conditions acceptable to the Bank, for a period of about two years (Section 3.02 of the Loan Agreement).

Training

5.09 The main training needs would be for ADC staff engaged in the design of minor irrigation and upland reclamation sub-projects and for FLIA managers. Training of ADC minor irrigation designers, both in-service and on short study tours to other countries, would be largely associated with the program to improve hydrologic services. A program for training ADC upland reclamation design and construction staff would be devised by the upland reclamation adviser (para 5.07) and would include in-service training and short study tours to adjacent countries. FLIA managers associated with the project would travel to Japan or Taiwan in groups of 10 to 15 to observe the operation and maintenance of irrigation systems. Selected MAF or ADC staff would attend overseas seminars or short courses in project planning and evaluation. Further details are given in Annexes 3 and 4. Financing from the Loans of the foreign costs of other training needs identified during the course of project implementation would require the Bank's approval. Arrangements for submitting and approving training requests under the project were agreed upon at negotiations.

Operation and Maintenance

5.10 The completed minor irrigation sub-projects would be operated and maintained by the FLIA's. The standard of operation and maintenance (O&M) of similar works completed in the past is generally quite satisfactory. The cost of adequate O&M (in early-1976 prices) would average about Won 28,000/ha (US$57/ha) for reservoir systems and Won 37,000/ha (US$77/ha) for pumping stations, but there could be wide variations between sub-projects. These

costs also include some agricultural extension services (para 5.20). KECO would be responsible for O&M of the rural electrification sub-projects which would be integrated with the overall power network. The other components would be maintained by the villagers themselves, under the guidance of the Saemaeul leader (or VFA chief). In most cases, O&M by the villagers has been satisfactory but some improvement is needed for village roads and water supplies. A regular cash contribution would be collected from water supply consumers to pay for cash costs of operation (electricity, repairs, chemicals, etc.) and also, in many cases, to generate a small surplus for the village development fund (Annex 7). Roads and bridges would be maintained by voluntary labor. Present standards of road maintenance are not adequate but would be improved under the project through closer supervision of standards by county staff. The small amount of labor needed to maintain upland reclamation sub-projects and fuelwood blocks would be provided by the villagers. An assurance has been obtained that all facilities to be constructed under the project would be operated and maintained in accordance with sound engineering practices and that, where operation and maintenance is the responsibility of the villagers, a system of regular periodic inspection by county-level staff would be established (Section 3.08 of the Loan Agreement).

Cost Recovery

5.11 Minor Irrigation and Upland Reclamation. For minor irrigation, farmers would pay the full cost of O & M, through a water charge imposed by the FLIA, as well as repaying a loan equal to 30% of the capital cost of the project (about US$1,120/ha on average excluding a small amount of contributed labor) at 3.5% interest with repayment over 35 years (Annex 14). Farmers also pay a production tax of 6% of all foodgrain production above 1.4 ton/farm, the assumed subsistence level. Using a discount rate of 10% (the opportunity cost of capital in Korea) and a period of 50 years, this implies a cost recovery index 1/ of 23% and a benefit recovery index 2/ which varies from 24% to 31%, depending on farm size. Water charges and direct taxes would be equivalent to 18% to 21% of incremental income due to the project, depending on the farm size. The adequacy of these charges is assessed in Annex 22, by comparing them with the "project rent", which is defined as incremental net farm income before paying water charges less the value of family labor, farm management, the return on the farmer's own investment and an allowance for uncertainty. The implications of the proposed

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1/ Defined as the ratio of the present worth of incremental revenues due to the project to the present worth of the incremental costs associated with the project.

2/ Defined as the ratio of the present worth of incremental revenues due to the project to the present worth of incremental income accruing to the project beneficiaries before payment of water charges and debt service but after payment of incremental general tax payments.

charges for income distribution are also examined. According to this analysis, the proposed charges are about 50% of project rent, or more than the theoretically optimum level for the smallest farmers, and about 70% of project rent for the larger farmers (or an overall "rent recovery index" of 60%). Despite the slight inequity on small farmers, the proposed charges are regarded as satisfactory from the point of view of overall benefit recovery, especially in view of the excellent record of previous projects of this kind in Korea - collections have typically exceeded 98% of assessments. The beneficiaries of upland reclamation sub-projects would contribute 10% of the project cost in labor and would repay 30% of the capital cost at 9% interest, with repayment over eight years (Annex 14). This implies a cost recovery index of 28%, which is satisfactory, given the risk associated with rainfed cultivation and the income level of the beneficiaries (Annex 22).

5.12 Other Components. For the fuelwood component, the beneficiaries would contribute labor for plantation establishment, which equals 45% of the total imputed project cost (Annex 10), plus all maintenance. For roads, the labor contribution equals 45% of total imputed costs (30% for bridges) plus all maintenance. For water supply, the beneficiaries would contribute about 35% of the capital cost in the form of labor and finance all O&M through cash contributions. Electricity consumers would pay an energy charge which covers the costs of generation, transmission and O&M of the project works. The tariff schedule is uniform throughout Korea and there is a tax of 15% on energy sales. There is little or no cross-subsidy between consumers. Rural consumers would pay the full cost of internal wiring and would also repay a loan for 90% of the capital cost of the sub-project, with interest at 7.5% and a repayment period of 35 years. All the above provisions are satisfactory, allowing for the nature of the services provided, the extent to which individual beneficiaries can be identified and the position of the beneficiaries in the national income scale. Part of the Government's philosophy for the Saemaeul Movement is that the proportion of Government subsidy should gradually decline for future projects, as each village becomes more self-reliant (para 3.04).

5.13 For each component, assurances have been obtained that project beneficiaries would continue to contribute to the capital and annual cost of facilities to be provided under the project, at no less than the existing levels, which are described above (Sections 3.13, 3.14, 3.15, 4.04, 4.05 and 4.06 of the Loan Agreement).

Project Coordination

5.14 The level of funding for rural development is such that only a very small number of high-priority projects can be constructed in a given village in a single year. Thus it is unlikely that a given village would benefit from more than one or two sub-projects of the present project and consequently, the need to coordinate the construction activities of the various executing agencies in the field would be minimal. However, at the sub-project selection stage it has been necessary to ensure that sub-projects are not recommended where the necessary prerequisites do not exist. For

example, an electrification sub-project should not be proposed for a village without road access or an electric well pump for a village without a power supply. In addition, there is a need to match the selected sub-projects with the physical and institutional capacities of the villages concerned. These questions are considered by the existing hierarchy of Saemaeul Coordinating Committees at each level of government (para 3.07). These arrangements are satisfactory and would be continued under the project.

Project Monitoring

5.15 The Government has designated EPB as the appropriate agency to monitor the progress of the project, to draw the attention of the executing agencies to any problems or delays and to act as a channel of communication with the Bank. At the end of each calendar quarter, the executing agency for each component of the project would prepare a progress report, giving the physical status and expenditure on each sub-project on the master list (para 4.21). This report would be forwarded by the responsible Ministry to the EPB, together with a statement from the Auditing Office of the Ministry (para 4.23). A Project Monitoring Unit would be established within EPB's Budget Bureau to receive these reports, check them for internal consistency and for conformity with Ministry of Finance records of disbursements against the project components, prepare a summary of the overall physical and financial progress of the project (including information on procurement, to be supplied by OSROK) (para 4.18) and would prepare an application for reimbursement, based on the total expenditure during the quarter (para 4.20). Except for the minor irrigation and upland reclamation components, for which MAF's complete report would be forwarded, only the summary would be sent to Washington in support of the disbursement application. The detailed reports of the executing agencies would be available in Korea for review by supervision missions. Formats for the detailed reports and the summary were agreed upon during negotiations.

5.16 Assurances have been obtained (Section 3.09 of the Loan Agreement) on the following points:

(a) The EPB would establish a Project Monitoring Unit in its Budget Bureau and would appoint suitable staff to the Unit;

(b) The Ministries responsible for the various components of the project would submit to the EPB within one month of the close of each calendar quarter, a detailed report on the physical and financial progress of all sub-projects, in a form acceptable to the Bank; and

(c) The EPB would submit to the Bank, within two months of the close of each calendar quarter, a summary report on the physical and financial progress of the project, together with information on procurement and spot checking in a form acceptable to the Bank.

The establishment of the Unit is proposed as a condition of effectiveness of the Loans.

Project Evaluation

5.17 The proposed project is unusual in that it is part of a multi-sectoral and nationwide rural development program, with an emphasis on decentralized decision-making and self-help. Therefore, careful attention should be given to evaluating the results of the project and, to a lesser degree, to studying the achievements of the Saemaeul Movement generally. Studies done to date have been preliminary in scope and have no formal links to the Government's planning and executing agencies.

5.18 Under the project, the Economic Planning Bureau of the EPB would assume responsibility for evaluation studies. The Bureau, in consultation with the Bank, would draw up a three-year program of studies, prepare terms of reference, monitor the progress of the evaluation studies, review their conclusions and incorporate their findings in future rural development planning. High priority studies would include: measurement of the benefits of the project components, particularly upland reclamation, roads and bridges, and water supply, for which few data are available at present; anlysis of the effectiveness of the present administrative, coordinating and sub-project selection mechanisms; the measurement of changes in rural attitudes to development; and, an assessment of investment priorities for villages at various stages of development. Clearly, not all these questions will be answered in a three-year period but it is hoped that the evaluation mechanism to be established under the project would have permanent value. Evaluation data could also be used in the preparation of a follow-up project for Bank consideration, which might include sectors other than those included in the present project.

5.19 Evaluation studies would be carried out by a number of agencies. Some of the more straightforward studies (for example, traffic volumes on village roads) would be carried out by the responsible Ministry. Others would require specialized research bodies, such as the Korea Development Institute, the National Agricultural Economics Research Institute, the Universities, and possibly consultants. The nature of the studies was discussed at negotiations. An assurance has been obtained that a program of evaluation studies would be submitted by the Economic Planning Bureau of EPB within six months of Loan signing, and that the Bank would be consulted periodically on the scope and form of such studies.

Agricultural Supporting Services

5.20 Research and Extension. The Office of Rural Development (ORD) of the MAF is responsible for research and extension, which are more advanced in Korea than in most developing countries. Research is aimed at crop yield improvement, earlier-maturing varieties (to increase cropping intensities) and disease resistance. ORD's Extension Bureau has county offices, with about 15 subject matter specialists, and district offices, with four or five field extension workers, or one worker per 350 to 500 farmers, which is satisfactory. In irrigated areas, additional extension staff are employed by the FLIA's. In order to ensure a rapid build up of benefits from the minor irrigation

component, an assurance has been obtained that ORD or the responsible FLIA would appoint an additional extension agent in every myon (district) in which a minor irrigation sub-project would be constructed, within one year of Loan signing. Guidance to those farmers benefitting from upland reclamation would require special attention, in order to achieve high yields and to maintain the project works without causing excessive erosion (Annex 4). As the existing extension staff are not specially trained in these areas, an assurance has been obtained that ORD would cooperate with ADC in training extension workers in soil conservation and would appoint, within one year of Loan signing, suitably trained extension workers in every gun (county) in which an upland reclamation sub-project would be constructed (Section 3.03 of the Loan Agreement and Supplementary Letter).

5.21 Agricultural Credit. The Government-sponsored cooperative system, the National Agricultural Cooperative Federation (NACF), is the main source of institutional credit and supplies about half of total credit needs. Most loans are at 9% per annum interest. Institutional credit is supplemented by private sources and the farmers' own savings. Availability of additional credit (expected to total Won 6 billion per year) is expected to be sufficient to permit the use of inputs at the projected rates.

5.22 Farmers' Organization. The principal farmers' organizations are the FLIA's (para 5.02). At a lower level, farmers are organized into Hung Nong Cae ("farmers' action groups"), which are responsible for water distribution at the local level and act as points of contact for the extension workers. The Hung Nong Gae are also responsible for small-scale improvement works, collection of water charges, hiring out of farm machinery and yield surveys.

5.23 Seeds. Until recently, seed production was largely a responsibility of the Provincial ORD branches, with little central coordination. As a result, seed has been produced in sufficient quantity but its quality has not always been adequate. Under a recent Bank-assisted Seeds Project (Loan 942-KO), a new Seeds Law has been passed and an Office for Seed Production and Distribution established. These steps, together with improvements to processing plants and technical assistance, should ensure that the availability of quality seeds is not a constraint on the agricultural components of the project. Further details on agricultural supporting services are given in Annex 16.

VI. BENEFITS AND JUSTIFICATION

6.01 The Rural Infrastructure Project would benefit about four million people (about 30% of Korea's rural population or about 15,000 villages), through intensification of agricultural production, opening up of new farmland, expansion of fuelwood production, reductions in transport costs and an improvement in the quality of rural life, through the provision of water supply and electricity. The number of beneficiaries is unusually high because there would be little "overlap" between the sub-projects of the various sectors. The project would also encourage decentralized decision-making, help to develop village-level institutions, and would be a further

step in the Government's efforts to narrow inequalities between the urban and rural sectors, as well as within the rural sector. Other impacts of the project include an increase in short-term and long-term employment and a reduction in foodgrain imports.

6.02 Because the 15,000 or so sub-projects would be scattered throughout Korea, there would be little interaction between the various components. Thus it is appropriate to analyze each component separately. Where possible, an indicative economic rate of return, based on a "typical" sub-project or on average conditions, has been calculated. In the case of rural electrification, a modified financial analysis has been used to produce a minimum estimate of the economic rate of return. Quantification of the benefits of water supply has not been possible and a qualitative justification is therefore used.

Assumptions

6.03 Prices and Foreign Exchange. All prices have been adjusted to a projected early-1976 level; whenever possible crop prices for economic analysis have been based on the Bank's projections of 1985 world market prices. Thus the world market price was used for rice, soybeans, and tobacco. In the absence of price forecasts for polished barley for human consumption, a price equal to 85% of that projected for wheat flour was used. For other crops, and for farm income analysis, average farmgate prices for the last five years (adjusted for inflation) have been used. As there is little market for fuelwood, the value was determined in terms of agricultural residues and coal, the alternative fuels for which it would be substituted. For the purpose of economic analysis a shadow foreign exchange rate of Won 560 = US$1 (compared to the official rate of Won 485 = US$1) was used to value the internationally traded commodities (rice, barley, soybeans and tobacco) and the foreign exchange component of the agricultural inputs and the construction cost. The shadow exchange rate is based on research undertaken by the Korea Development Institute.

6.04 Labor. As the demand for unskilled labor is highly seasonal in the rural areas of Korea, seasonal shadow pricing is appropriate. As the the rural labor force is approximately fully employed during the crop season and is also fairly mobile, it is appropriate to use observed wage rates for hired labor as the opportunity cost of labor, that is, Won 1,800/day for April, May, July, August and September and Won 1,900/day for the peak months of June and October. During the winter months there is little wage employment. There is, however, some self-employment, notably the weaving of bags from rice straw, for which the net value of production is about Won 450/day -- this value has been used to represent the opportunity cost of unskilled labor during the period November to March.

Minor Irrigation

6.05 Cropping Pattern and Yield. The analysis (Annex 17) is based on the effect of the project on whole farms. In addition to the irrigated service area of about 14,000 ha (of which 9,400 ha is presently grown to rice) the project area farms also include an additional 4,600 ha of upland. As a

result of the conversion of uplands to paddy, farmers will have to adjust their cropping pattern. It has been assumed that they will try to preserve the area of high-value crops. A small increase in yield has also been assumed for the upland crops, due to additional extension efforts and lower costs for transporting inputs, due to improved access. Present and future cropping patterns and yields were estimated for three climatic regions of Korea - North, Southwest and Southeast. Details are given in Annex 15. The following yields (on a milled or polished basis) were assumed for the major crops:

Crop	Region		
	North	Southwest	Southeast
	ton/ha		
Traditional Rice - Present	2.4	2.7	2.7
- Future Without Project	2.6	2.8	2.8
- Future With Project	3.4	3.5	3.5
Improved Rice - Present	2.8	3.1	3.1
- Future Without Project	3.0	3.3	3.3
- Future With Project	3.9	4.2	4.2
Barley - Present	1.9	2.0	2.0
- Future Without Project	2.0	2.2	2.1
- Future With Project	2.2	2.5	2.5

6.06 Farm Income. Three farm sizes have been examined: 0.5 ha; 0.9 ha (which is the average farm size in Korea); and 1.8 ha. The cropping pattern was varied between the farm sizes to reflect the more intensive land use on small farms. Farm budgets, which provide for hired labor and animal power, taxes, water charges and debt service, are shown in Annex 17. At full development (Year 7 onwards), the net income of an average-sized farm would be Won 885,000 (US$1,820), compared to Won 540,000 (US$1,100) at present (or 12% lower than the national average farm income). Farmers with 0.5 ha of land would increase their income by 63% from Won 340,000 to Won 555,000. These calculations, which exclude off-farm and non-agricultural income, show that the beneficiaries would have sufficient financial incentives to participate in the project. About 24,000 farm families would benefit from the component.

6.07 Economic Analysis. Using shadow prices for inputs, outputs and labor, neglecting transfer payments, and assuming a salvage value for the project works of 25% at the end of the evaluation period of 35 years, the economic rate of return of the whole component was found to be 13%. Sensitivity tests showed that the price of rice is the only assumption to which the rate of return is particularly sensitive. Using the estimated construction costs for the sub-projects in each region, the rates of return for the three areas were 13%, 13% and 12% respectively.

Upland Reclamation

6.08 Farm Income. Following the selection criterion that at least one-third of the sub-project areas should be devoted to high-income crops (para 4.09), a cropping pattern was devised, which includes high-value

fruits (apples) and vegetables, as well as low-valued grains, pulses and pasture (Annex 15). As the component is relatively small and somewhat of a pilot nature (para 4.03), regional variations were not considered and only one farm size (1.0 ha of reclaimed land) was analyzed. As the return from apples (at full development) is much higher than for the other crops, the effect of omitting fruits from the cropping pattern was also tested. The additional farm income due to the project is estimated at Won 1,000,000 (US$2,060) or Won 570,000 (US$1,200) if apples are excluded. This should provide adequate incentives to the farmers, even allowing for the inherent risks of rainfed cultivation. About 5,000 farm families would benefit from this component.

6.09 Economic Analysis. Under similar assumptions to those for the minor irrigation component, the rate of return is estimated at 21% (for both cropping patterns). Details are given in Annex 18. The higher ultimate income from fruit is offset by several years of negative cash flow during the growing period.

Fuelwood

6.10 As returns from timber production are known to be greater than that for fuelwood, a mixture of fuelwood species only was assumed, in order to obtain a minimum estimate of the rate of return of the component. Details of the analysis are given in Annex 19. Only the value of fuelwood production was quantified, as the other benefits of this component (such as additional production from the surrounding natural forest and a reduction in erosion and flood peaks) did not lend themselves to evaluation. Volunteer labor for plantation establishment maintenance and harvesting was valued at a shadow wage rate (para 6.04). The resulting economic rate of return is 19% and it was not found to be unduly sensitive to any of the assumptions made in deriving it. Beneficiaries of this component would number about 150,000 households.

Roads and Bridges

6.11 For roads sub-projects, an analysis (Annex 20) was made of the economic viability of various combinations of road length (from 2 to 6 km) and agricultural land served (from 25 ha to 200 ha). Time savings in the transport of inputs and outputs to maintain the existing level of agriculture were evaluated and the changes in cropping pattern likely to occur as a result of lower transport costs were estimated, based on surveys elsewhere in Korea. The resulting rates of return are shown in Annex 20, Figure 1. A cutoff rate of return of 8% is suggested, as indications are that other benefits (such as improved access to job opportunities in the rural towns) would add about 3% to the rate of return calculated purely on agricultural benefits. As the sub-project selection process is not yet completed, no overall rate of return for the component is available. The rate of return for a typical road, 3 km long and serving 150 ha, would be at least 16%. About 44,000 households would benefit from the roads and bridges component.

Water Supply

6.12 The major benefit of the water supply component would be an improvement in the quality of village life for about 150,000 families. The standard of service (house connections) would be appropriate to the level of income of the beneficiaries and may be considered as a necessary complement to other more directly productive rural investments. In addition, the water supply component would have some health benefits, would result in some time savings, and would assist in developing the institutional capacity of the villages for further development. However, none of these benefits could be readily quantified and no attempt at numerical analysis has been made. Given the cost recovery arrangements of the component, a modified financial analysis, similar to that undertaken for electrification (para 6.13), would tell us little about the value of the service to the consumers. However, the fact that the villagers contribute about 35% of the capital cost, in the form of volunteer labor, as well as all O&M costs, is an indication of the high value that they place on this service and strengthens the conclusion that it is justified.

Rural Electrification

6.13 The projected growth of demand for electricity and the division of this growth between domestic and small power consumers was based on observed trends in other rural areas of Korea, with a reduction for the fact that the villages to be electrified under the project are somewhat smaller and more remote than those which have already been served. Further details are given in Annex 21. Revenues from rural electrification, which measure willingness to pay and are thus a minimum estimate of the benefits of the component, were calculated using KECO's 1975 tariff structure and the Government's 15% electricity tax. Using the construction cost of the component and KECO's estimates of generation, transmission, maintenance and administrative costs, a minimum estimate of the economic rate of return was found to be 10%. This estimate, which takes no account of the consumers' surplus or a recent tariff increase, is moderately sensitive to the rate of growth of demand and the price charged. The electrification component would benefit 305,000 households.

Other Impacts of the Project

6.14 Food and Fuel Production. At full development, the project would increase Korea's production of rice by 26,000 tons (10% of rice imports in 1974), barley by 13,000 tons (4% of 1974 barley imports), potatoes by 24,000 tons, cabbage and other vegetables by 10,000 tons, and fruit by 36,000 tons, with minor effects on other crops. No marketing problems are anticipated. The project would result in foreign exchange savings of approximately US$7 million annually. About 640,000 tons of fuelwood would be produced annually, allowing 500,000 tons of agricultural residues to be used for soil improvement and reducing the consumption of coal by 170,000 tons.

6.15 Employment. Project construction would require about 13.8 million man-days of unskilled village labor, mostly on a volunteer basis, which would

reduce chronic underemployment in the off season. The additional permanent employment from the agricultural components (neglecting the second-round effects of the other components) would be equivalent to 3,900 full-time jobs.

6.16 Income Distribution. While no survey data are available on the present incomes of the project beneficiaries, it may be assumed that, as the project is aimed at "basic" and "self-help" villages (para 3.13), the benefitting villages on the whole would be below the national rural average income and thus be considerably below the national average income level. The project would therefore improve the national income distribution and it has been very roughly estimated that 20% of the project's benefits would accrue to the 25% of the rural population who, in the Bank's definition, are in absolute or relative poverty. The project would have only minor effects on income distribution within the villages it would serve.

VII. AGREEMENTS REACHED AND RECOMMENDATION

7.01 Agreements were reached with the Government during negotiations on the following major points:

(a) design standards for upland reclamation (para 4.10);

(b) availability of funds in the 1976 budget (para 4.17);

(c) the master list of sub-projects (para 4.23);

(d) formats for the quarterly reports (para 5.15); and

(e) the evaluation studies (para 5.19).

7.02 During negotiations, assurances were obtained from the Government on the following major points:

(a) design standards for the upland reclamation component, to be agreed upon at negotiations, would be employed throughout the implementation of the project (para 4.10);

(b) OSROK would submit to the Bank, through the EPB, periodic reports on the procurement of materials (para 4.18);

(c) each executing agency would maintain a separate project account, these accounts would be audited annually by the auditing section of the responsible Ministry and ultimately by independent auditors acceptable to the Bank, and the Auditors would submit to the Bank, within five months of the close of a fiscal year, an audit report on the project accounts, in such detail as the Bank may request (para 4.21);

(d) the quarterly reports of the executing agencies would be accompanied by a statement by the responsible Ministry on the results of its spot-checking of physical progress (para 4.23);

(e) ADC would employ, within four months of Loan signing, an upland reclamation adviser, with qualifications and experience acceptable to the Bank, for a two-year period (para 5.07);

(f) MOC would employ, within six months of Loan signing, a consulting firm specialized in hydrologic analysis acceptable to the Bank, under terms and conditions acceptable to the Bank, for a period of about two years (para 5.08);

(g) for each component, project beneficiaries would continue to contribute to the capital and recurrent project costs at no less than the existing levels (para 5.13);

(h) EPB would establish a Project Monitoring Unit in its Budget Bureau and would appoint suitable staff to the Unit; the Ministries responsible for the various components of the project would submit to EPB within one month of the close of each calendar quarter, a detailed report on the physical and financial progress of all sub-projects, in a form acceptable to the Bank; and EPB would submit to the Bank, within two months of the close of each calendar quarter, a summary report on the physical and financial progress of the project, together with information on procurement and audit results, in a form acceptable to the Bank (para 5.16);

(i) ORD would appoint an additional extension agent in every myon (district) in which a minor irrigation sub-project would be constructed, within one year of Loan signing (para 5.20); and

(j) ORD would cooperate with ADC in training extension workers in soil conservation problems and would appoint, within one year of Loan signing, suitably trained extension workers in every gun (county) in which an upland reclamation sub-project would be constructed (para 5.20).

7.03 The establishment of a project monitoring unit is proposed as a condition of effectiveness of the Loans (para 5.16).

7.04 A proposed condition of Loan disbursement for the rural electrification component would be that a Subsidiary Loan Agreement, acceptable to the Bank, had been concluded between the Korean Development Bank and the Korea Electric Company (para 4.15).

7.05 With the above agreements and assurances, the proposed project would be suitable for a Bank Loan of US$20.0 million and an Intermediate Term Loan of US$40.0 million, both with twenty-five-year maturities and seven-year grace periods, following previous practice for agricultural projects in Korea. The borrower would be the Republic of Korea.

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KOREA

RURAL INFRASTRUCTURE PROJECT

Physiography and Land Use

Topography

1. The Republic of Korea covers 98,000 km^2 (Map 10375). The Korean peninsula is very rugged and mountainous, although no point in South Korea exceeds 2,000 m in elevation. Only about 15% of the land may be classed as plains and such plains as do exist are coastal, small in area and isolated from one another. The Taebaeg Range extends down the peninsula, close to the east coast (Map 10376). As a result, the western rivers are longer and have built up more extensive flood plains than those flowing to the east.

2. The west and south coasts are extremely indented, the flood plains of the numerous rivers alternating with rocky headlands and there are numerous offshore islands. The shoreline itself is indefinite, as a tidal range of up to 10 m alternately covers and exposes mudflats, shoals and low-lying islands. There is considerable potential for the creation of new land by diking off arms of the sea. Jeju, a volcanic island with an area of about 1,800 km^2, lies about 80 km off the south coast.

3. The principal rivers are the Han, Nagdong, Geum and Seomjin. The Han has a length of 540 km and drains an area of 33,000 km^2 (partly in North Korea). The Nakdong has a length of 730 km and drains 24,000 km^2. River flows show pronounced seasonal variations (para 6), are prone to flooding and carry high sediment loads, due to active natural and manmade erosion on the steep hillsides. As a result of deposition, riverbeds frequently aggrade and are often above the level of the surrounding flood plain, thus worsening the flood hazard.

4. The alluvial flood plains generally yield sufficient shallow groundwater to meet domestic needs (Annex 7) but to date there has been no significant development of groundwater for irrigation.

Climate

5. The climate of Korea is characterized by warm, moisture-laden southeast winds during summer and cold northwest winds from the central Asian high pressure area during winter. The mean monthly temperatures for various cities are shown in Table 1. Winters are pronounced in Korea but are neither as cold nor as dry as on the nearby mainland. The frost period begins in mid-October in the north, or mid-November in the south, and lasts until late-April, a range of 185 to 220 frost-free days. The agricultural implications of the frost free period are discussed in Annex 15.

6. The average rainfall amounts to about 1,250 mm per year, varying from 800 mm in parts of Gyeongsang Bug Province to 1,400 mm along the southern coast (Map 10376). About 60% of the rainfall is concentrated during the summer, from July to September. Mean monthly precipitation data for a number of stations is given in Table 2. Typhoons are rare in Korea but severe damage sometimes occurs. Even in the summar, rainfall is unreliable, especially during the critical transplanting period (June). Droughts also occur sometimes during August and September. Irrigation is therefore required to obtain optimum yields from high-yielding varieties of rice.

Soils

7. Korea's soils can be classified topographically into:

(a) Low plains soils consist of marine, marine-alluvial and silty soils and are mostly clay-loams and silt-loams. They account for about 1.3 million ha, and are usually cultivated with paddy.

(b) Hill and colluvial terraces are widely distributed over the west and southwestern zones of the country. They account for about 1 million ha, and are composed of silt-loams and silty clays. They are highly acid and poor in organic matter (Annex 4).

(c) The intermediate slope lands cover about 2 million ha and are of metamorphic rock origin. They are reddish-yellow, have low natural fertility and are subject to severe erosion.

(d) The soils of the mountainous areas cover around 7 million ha, of which about 6 million ha are forest lands. These soils are subject to severe erosion and, since their parent rocks include granite, schist and shale, they are highly acid and of low fertility. Extensive erosion control through reforestation would reduce the flood damages in the low lands through reduction of floods and of siltation of the river beds. There is evidence (Annex 5) that the reforestation programs of the last decade have had these effects.

Land Use

8. About 23% of Korea's land area is cultivated, 13% being used for paddy and 10% for upland crops. Although 67% of Korea's area is classified as forest, most high-grade timber production comes from the 840,000 ha (9%) of National Forests. Private forests consist of small trees and shrubs and are important only for fuelwood production (Annex 5).

9. Rice and barley are the major crops, accounting for two-thirds of the total crop area, and they are grown throughout the country, with a concentration in the western and southern coastal areas (Map 10378). Rice yields in Korea are much higher than those in South and Southeast Asia, reflecting

a high level of input use and good farm practices. However, yields are still 20% below those in Japan, indicating a margin for improvement. Other food crops (soybeans and other pulses, potatoes and miscellaneous cereals) grown mainly in upland areas account for about 18% of the cropped area. Fruits, vegetables, tobacco and ginseng are high-value crops, accounting for 11% of land area but almost one-quarter of crop value. Only small areas are used to grow maize and other feed crops. Livestock depend on crop residues, grazing of wastelands, rice bran and other by-products, as well as imported feeds.

Population, Farm Size and Land Tenure

10. Korea's 14.7 million farm people (or 2.5 million farm households) live mainly in the 35,000 or so villages (Map 10377). In 1971, cropland per farm household averaged 0.92 ha, of which 0.51 ha was paddy and 0.41 ha was upland. Farm households were classified as follows according to their principal source of income: rice farms 72%; upland farms, 18%; agricultural laborers with little or no land, 4%; and the remaining 6% as fruit, vegetable, special crop, livestock, sericulture and other types of farms. The national farm size distribution in 1971 is shown in Table 3. Nearly two-thirds of the farm households have less than 1 ha of cropland and they account for almost 40% of all cropland. Individual paddy fields average only 0.2 ha, which makes mechanization of farming operations difficult.

11. Most farmers own the land they cultivate. In 1965, almost 70% were classified as full owners, 23% as part owners, who operated some rented land in addition to land they owned, and only 7% as tenants. This contrasts sharply with the tenure situation in 1945 before land reform took place, when only 14% were full owners, 50% were tenants and the remainder part owners. Under the revised Farmland Reform Law of 1950, individual holdings cannot exceed 3 ha of cultivated land but there are no limitations on the areas of reclaimed land, undeveloped slope land or forest that an individual can own. The amount of cultivated land operated per household did not change as renters became owners.

12. Almost 75% of forest land is in private hands (Annex 5), with 54% of the woodlots being less than 1 ha and 94% less than 10 ha. About 1.5 million farm households own some forest land but the remaining 1 million have customary user rights for gathering fuel, forage and compost materials.

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Mean Monthly Temperatures (1931-1970) (°C)

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Seoul	- 4.9	- 1.9	3.6	10.5	16.3	20.8	24.5	25.4	20.3	13.4	6.3	- 1.2	11.1
Incheon	- 4.0	- 1.6	3.4	9.7	15.3	19.6	23.9	25.1	20.6	14.2	7.2	- 0.4	11.1
Gangneung	- 1.0	0.3	4.7	11.5	16.7	19.9	23.5	24.3	19.7	14.4	8.8	2.4	12.1
Jinju	- 1.7	0.2	5.0	11.3	16.9	21.4	25.7	25.9	20.6	13.9	7.8	1.7	12.4
Gwangju	- 0.6	1.1	5.7	11.4	16.8	21.4	25.6	26.1	20.9	14.0	8.2	2.4	12.8
Mogpo	1.0	2.1	5.9	11.5	16.5	20.6	24.8	26.1	21.7	16.1	10.3	4.3	13.4
Yeosu	1.5	3.0	6.8	12.3	16.8	20.2	23.9	25.8	21.9	16.6	10.9	4.5	13.7
Chupungryeong	- 3.1	- 0.7	4.5	11.0	16.7	20.6	24.5	24.7	19.4	13.0	6.7	0.2	11.5
Pohang	0.6	2.2	6.1	12.1	16.8	20.1	23.6	25.0	20.6	15.2	9.9	3.4	13.8
Daegu	- 1.6	0.6	5.7	12.1	17.6	21.6	25.3	25.9	20.5	14.2	7.8	1.4	12.6
Busan	1.8	3.6	7.3	12.5	16.7	19.8	23.7	25.4	21.6	16.6	11.1	5.0	13.0
Ulsan	0.4	2.1	6.0	11.5	16.3	20.0	24.3	25.1	20.5	14.8	9.0	3.2	12.8
Ulnung Is.	0.6	1.1	4.5	10.2	10.2	18.4	22.1	23.9	19.9	15.0	9.7	0.9	11.4
Arithmetic average	-0.8	1.2	5.3	11.4	16.1	20.3	24.5	25.3	20.6	14.8	8.8	2.7	12.2

ANNEX 1
Table 1

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RURAL INFRASTRUCTURE PROJECT

Mean Monthly Precipitation (1936-1970) (mm)

Station	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Annual
Seoul	17.1	21.1	55.6	86.1	86.3	169.3	358.0	224.2	142.3	49.2	36.0	32.0	1,277.2
Incheon	15.8	17.9	49.9	66.3	72.5	139.4	303.8	180.4	136.7	45.0	35.1	30.0	1,092.8
Suweon	20.6	19.2	53.7	71.8	81.9	168.9	333.8	219.3	156.8	50.0	37.7	34.1	1,247.8
Kangneung	36.9	73.4	73.1	70.4	64.1	134.9	212.1	190.7	197.5	87.8	88.0	53.2	1,282.1
Chuncheon	18.9	20.6	42.2	71.7	84.2	121.4	362.6	244.2	138.5	45.0	39.8	25.8	1,214.9
Cheongju	22.2	26.0	38.3	82.8	79.5	142.7	322.2	214.3	134.3	43.3	37.4	28.1	1,171.1
Jeonju	26.6	32.8	61.0	76.4	84.7	154.6	279.7	239.6	156.4	51.5	41.7	35.5	1,240.5
Seosan	18.1	24.5	32.3	76.6	80.0	123.3	297.8	226.3	154.1	38.1	47.8	36.1	1,155.0
Daejen	24.1	30.0	38.1	82.5	82.2	146.9	300.0	222.0	117.9	45.5	39.7	34.6	1,163.7
Kunsan	22.8	21.9	33.8	78.0	76.7	154.3	227.8	201.5	143.3	47.3	48.2	33.5	1,089.1
Gwangju	31.5	34.4	69.1	82.2	92.0	168.8	222.6	201.2	139.5	51.9	42.9	36.8	1,172.9
Mogpo	37.4	40.2	58.4	82.9	101.6	136.0	187.8	187.8	156.0	55.4	44.2	43.3	1,131.0
Yeosu	17.1	40.2	80.2	124.2	149.7	179.9	262.6	157.0	188.3	45.3	29.1	30.0	1,303.6
Chupungryeong	25.4	30.1	56.5	71.9	75.4	167.4	267.6	190.8	154.9	40.4	36.5	29.9	1,146.8
Pohang	29.5	40.5	57.4	67.4	74.5	139.3	157.7	134.1	173.0	59.2	59.7	35.6	1,027.9
Daegu	15.8	27.1	45.5	64.6	67.4	132.7	200.2	165.5	161.8	44.0	30.1	24.8	979.5
Pusan	25.8	44.1	88.5	113.5	139.3	197.5	247.6	165.0	205.1	73.1	43.9	38.5	1,381.9
Ulsan	24.2	46.3	68.0	88.4	106.3	154.1	203.7	166.9	208.7	65.0	46.3	39.8	1,217.7
Ulnung Is.	177.4	107.0	89.4	80.1	69.9	128.7	146.0	98.2	189.7	112.2	120.5	166.1	1,485.2
Geongju	24.3	33.7	68.1	119.0	153.6	194.0	274.9	159.2	166.7	71.4	46.6	36.3	1,347.8
Jeju	59.2	75.6	73.1	82.3	88.8	158.1	209.8	226.6	249.5	87.5	69.2	60.2	1,439.9
Seogipo	32.4	58.5	146.0	150.8	232.3	262.0	224.6	196.7	260.2	97.0	120.0	35.8	1,816.3
Arithmetic Average	32.9	39.3	62.6	85.9	97.4	157.9	254.7	191.4	169.6	59.3	51.8	41.8	1,246.9

ANNEX 1
Table 2

ANNEX 1
Table 3

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RURAL INFRASTRUCTURE PROJECT

National Farm Size Distribution
(1971)

Size of Farm (ha)	Percent of Total Number	Percent of Total Area	Number of Paddy Fields per Farm	Average Size of Paddy Field (ha)
0 - 0.5	33.6	11.4	2.9	0.11
0.5 - 1.0	31.7	27.3	4.4	0.17
1.0 - 2.0	26.0	41.1	7.0	0.21
2.0 - 3.0	4.8	13.4	9.3	0.25
Over 3.0	1.5	6.8	8.4	0.35
Total	100.0 a/	100.0		

Source: Agriculture Sector Survey, IBRD, November 13, 1973.

a/ Includes 84,000 farm households with no cropland.

KOREA

RURAL INFRASTRUCTURE PROJECT

The Saemaeul Movement

Background

1. The Saemaeul Undong (New Community Movement) was initiated late in 1971 by the President of Korea as a nationwide comprehensive self-help program to improve living conditions in rural areas, achieve greater decentralized economic growth, and slow the influx of rural people to the large metropolitan centers. The Movement is a successor to the "Self-Help Works Program" (1964-1972), which in turn was based on the "National Construction Service" (1961-1964). These programs were relatively modest in scope (US$10 to 20 million per year) and were financed from counterpart funds generated by the sale of foodstuffs provided by USAID under PL 480. Needy rural people were employed, mainly on upland reclamation (Annex 4), tidal land reclamation, irrigation, flood control, reforestation and road projects, and were paid partly in cash and partly in food. These earlier programs, with their emphasis on social welfare, were administered by the Ministry of Health and Social Affairs.

2. The Saemaeul Movement is broader in scope than these earlier efforts and includes a greater degree of self-help and decentralized decision-making. It has three main objectives:

(i) physical and environmental improvements by cooperative group action;

(ii) increased productivity and incomes, principally by creating more non-agricultural jobs in rural areas but also by raising agricultural productive capacity through more effective use of land and water resources; and

(iii) "spiritual enlightenment", that is, the modernization of thinking and social patterns to motivate rural people to improve their living conditions.

3. In 1972 and 1973, emphasis was placed on village improvement projects carried out mainly with voluntary labor during periods of the year when labor requirements for farm work are low. In 1974, however, the Government expanded the Saemaeul Movement to include rural development projects carried out with hired workers and the movement was also expanded to encompass projects in urban areas. The Government now includes under the Saemaeul Movement, programs for creating new employment opportunities by public works projects in urban as well as rural areas. Many of these programs are not new but have

been reoriented to give the rural people a greater say in project planning and execution (para 9).

4. Villages are classified into three groups, as follows:

(a) Basic Villages - These lack organization and leadership as well as the resources required to carry out community improvement projects and therefore require guidance and financial assistance from the Government to initiate self-help projects;

(b) Self-Help Villages - These have acquired sufficient leadership and organizational ability to identify and carry out village improvement projects but lack the full financial resouces to implement them and therefore require some Government technical and financial support; and

(c) Independent or Self-Reliant Villages - These have carried out environmental improvement projects, significantly raised rural incomes, and achieved some degree of financial viability, so that they can finance additional rural development projects from their own resources or from loans.

5. Table 1 shows the numbers of villages in each group at present. About 60% of villages fall in the "self-help" category. The Government expects that, as the Saemaeul Movement continues, villages will move from one category to the next and official planning shows all villages in the "independent" category by 1981. While there do not appear to be hard and fast rules as to the types of projects to be undertaken by each category of villages, the pattern seems to be that "basic" villages undertake only simple environmental improvements, such as roof improvements, kitchen improvements, village community halls, laundries, drains and the like. Such projects are low cost and may have only a limited economic impact but they do serve to train the village leaders and to build a sense of community. Self-help villages are expected to concentrate on infrastructural projects, such as roads, bridges, minor irrigation systems, water supplies and electrification. Most such projects have a subsidy element but self-help, either in the form of communal labor, or a loan obligation, is still significant. Finally, the "self-reliant" villages undertake directly productive, or "income", projects such as livestock raising, silk production, specialty crops and cottage industries. These projects are normally financed by credit, with little if any subsidy element.

Organization

6. The organizational structure of the Saemaeul Movement has two main characteristics:

(a) Within the government, Saemaeul activities are channeled through the existing government agencies and through the existing technical review and budgetary approval procedures.

This arrangement does create a problem of adapting agency priorities to development needs (as perceived by the villagers) but, on the other hand, it ensures the integration of Saemaeul activities into the established government programs and operating procedures.

(b) Within the villages, the Saemsaeul Movement attempts to build new institutions and to train a new generation of village leaders.

7. At the national level, general policy issues for the Saemaeul Movement are dealt with by a Vice-Ministerial Coordinating Committee, chaired by the Minister of Home Affairs, and with representatives from all Ministries dealing with Saemaeul activities (principally the Economic Planning Board, and the Ministries of Home Affairs, Education, Agriculture, Commerce and Industry, Construction, and Health and Social Affairs). A Saemaeul Coordinating Committee of senior officials from each Ministry translates these general policy directives into sectoral targets and planning guidelines for the Ministries. Each Ministry then prepares a detailed program and budget request. There are also Saemaeul Coordinating Committees, consisting of representatives from all the government agencies concerned, at the Provincial, county and district levels. These committees receive requests from the level below and allocate funds to the highest priority projects, within the overall guidelines set by each Ministry. In allocating funds between Provinces (and thus between counties, and so on) some Ministries pro-rate the available funds on the basis of population. However, in most cases, there is a rational plan to complete the coverage of a particular service or to fully develop the potential for a given activity and, in such cases, funds are allocated on the basis of the volume of work remaining to be done. Further details for particular sectors are given in Annexes 3 to 8.

8. The Ministry of Home Affairs (MHA) is responsible for fostering the Saemaeul Movement, for training its leaders, and for administering many of the more basic kinds of projects. The principal units in MHA responsible for Saemaeul activities are shown in Annex 6, Figure 1. These units include the Saemaeul Projects Bureau at the Central Government level, Saemaeul Guidance Sections in the Provincial administrations and smaller units at the county and district levels. Each county has a technical guidance team of about five members to assist villages in the design and supervision of roads, water supplies, irrigation systems, buildings and other engineering projects.

9. At the village level, each village has a Saemaeul Committee of about 15 members, elected by the villagers. At meetings of the committee, community needs and objectives are discussed. Each village elects a Saemaeul leader, who presides at Saemaeul Committee meetings and assigns work on self-help projects. It also elects a woman leader, who helps get the participation of women in household improvement projects. In most villages, the Saemaeul leader is not the village chief, who is appointed directly by the Provincial Government, but is a younger man with above-average education or skills.

Sub-Project Selection

10. After the village decides on its priorities, it submits a request to the District Saemaeul Committee (para 7) and thence to the County Committee. These committees examine the technical feasibility of the request, for which they rely on the advice of the government agency concerned, and the suitability of the proposed project for the state of development of the requesting village (para 5). The past record of the village and its willingness to contribute cash or labor to the project are also taken into account. In some cases, projects are suggested by the officials comprising the district or county committees rather than the villages itself but this appears to occur mainly in the case of larger-scale projects (such as irrigation and upland reclamation), which benefit several villages. There appears to be no difficulty in persuading the village that such projects would be in their best interest.

11. Within the village, decisions are reached by majority rule. Minority opposition is generally overcome by persuasion and the available evidence indicates that few, if any, villagers refuse to participate in the selected projects. The well-disciplined Korean social structure and the country's Confucian heritage appear to faciliate this lack of dissension. For some kinds of projects, for example, fuelwood plantations, benefits accrue proportionately to the number of days of labor contributed. While it would be difficult to believe that project initiation is always at the grass-roots level and that participation is completely voluntary, there is no denying the apparent enthuasiasm of the villagers for the Saemaeul Movement and the great amount of work that has already been completed. In nearly all cases, the projects selected appear to be appropriate to the needs of the village.

Government Assistance

12. Each "basic village" is entitled to receive a contribution from the Government of 500 sacks of cement (10 tons) and 1 ton of reinforcing steel, plus some tools and moulds for tiles and building blocks. A majority of Korea's villages have used up this basic allocation on roof improvements and other environmental projects. Additional free materials are then available for specific projects. The extent and form of government assistance for each of the components of the present project is discussed in the appropriate Annex.

Scope and Achievements of the Saemaeul Movement

13. The geographical and sectoral scope of Saemaeul Movement has evolved and expanded since 1971. Initially conceived of as a self-help program for rural areas, it has grown to include projects carried out with hired workers and to encompass urban areas. The main thrust of the Saemaeul Movement remains nevertheless directed toward rural areas and agriculturally-related activities. The national breakdown of Saemaeul activities by sector has changed from year to year, reflecting the influence of three main factors:

(a) the development priorities of the government;

(b) the number of village in each Saemaeul category; and

(c) the maturing organizational structure (at the Government and village levels) and improving project selection procedures.

14. Due to the changing nature of the Saemaeul Movement and its emphasis on decentralized decision-making, small-scale projects and self-help, determination of the total investment in and the physical achievements of the Saemaeul Movement is difficult. Available data are summarized in Tables 2 and 3. According to official figures, a total of Won 175 billion (approximately US$567 million) was invested in Saemaeul projects between October, 1971 and May, 1974 with Won 104 billion in 1974 alone. It is worth noting that only 22% of the total investment was provided by the central and local government budgets. The remaining 78% was contributed by the villagers, in labor or cash. Of this, the most important component was their labor input -- 65% of the villagers' contribution (or 49% of the total gross investment) and estimated to total 215 million man-days. For the present project, which stresses less labor-intensive infrastructural programs, the Government contribution would be higher, about 50%. A sample survey conducted in 30 Saemaeul villages by the Korea Development Institute showed that an average rural household contributed 39 man-days during this 32-month period. The labor contribution increased with the stage of development of the village -- basic villages contributed only 21 man-days while self-reliant villages contributed 59 man-days (Table 4).

15. The physical achievements of the Saemaeul Movement up to 1974 include 28,000 km of village roads, 9,800 village water supply projects, 48,000 ha of land consolidation, and 52,000 ha of reforestation 1/. It is worth stressing that physical construction is only one objective of the Saemaeul Movement -- institution building and the development of self-reliance (para 2) are equally important, though more difficult to measure. Some programs of particular interest are described below:

Roof Improvements

16. At the end of 1974, straw-thatched roofs on 1.3 million farm houses had been replaced with tiles or corrugated steel roofs. It is expected that virtually all farm houses will have tile or steel roofs by the end of 1977. The Government provides materials free for this program and the rural people contribute their labor.

1/ In some cases, these totals do not correspond with the sector achievements described in Annexes 3 to 8. This is probably a definitional problem. For example, the above total for village water supplies may include wells in addition to simple piped systems. Saemaeul Movement totals may include rehabilitation, as well as new construction.

General Village Improvements

17. These include improving and widening village lanes, clearing and rearrangement of village streams, public laundry and bathing facilities, village halls, post offices, village compost stations and the like. The Government also supplies materials for these self-help projects.

Industrial Development

18. Saemaeul factories range all the way from simple machines for making sacks or rope out of rice straw to small plants for consumer goods, such as textiles. Government assistance in this sector is in the form of credit to private entrepreneurs.

Agriculture, Transport and Public Utilities

19. The achievements of the Saemaeul Movement in these sectors are discussed in Annexes 3 to 8.

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RURAL INFRASTRUCTURE PROJECT

Numbers of Saemaeul Villages by Type

Type of Village	Actual		Targets	
	1973	1974	1976	1981
Basic	18,415	10,665	-	-
Self-Help	13,943	20,000	20,165	-
Independent	2,307	4,000	14,500	34,655
Total	34,655	34,655	34,655	34,655

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RURAL INFRASTRUCTURE PROJECT

Saemaeul Movement

Physical Achievements in Selected Sectors, 1971-1974

	Unit	Up to 1971	1972	1973	1974	Total
RURAL ROADS						
Village Roads	km	6,046	12,000	10,842	5,361	34,249
Farm Feeder Roads	km	27,200	7,351	5,367	39,918	79,836
RURAL HOUSING						
Roof Improvements	1000 Bldgs.	-	413	477	400	1,290
Housing Units	Each	-	-	4,407	3,043	7,450
RURAL WATER SUPPLY						
Water Supply Systems	Villages	235	2,640	2,556	4,556	9,987
PUBLIC FACILITIES						
Village Halls	Villages	13,494	4,452	5,135	1,545	24,626
Public Bath Houses	"	2,111	2,063	1,390	351	5,915
Public Laundries	"	24,129	9,035	14,049	4,984	52,197
AGRICULTURAL INFRASTRUCTURE						
Irrigation Facilities	Projects	-	4,102	5,393	9,416	18,911
Public Warehouses	"	-	1,699	1,601	5,946	9,246
Public Compost Pits	"	51,793	3,097	1,522	3,590	60,002
Common Use Barns	"	-	757	162	405	1,324
OTHERS						
Reforestation	ha	231,159	-	12,385	39,855	283,399
Nursery Stocks	million trees	-	-	86	203	289
Rural Electrification	1000 households	849	164	308	177	1,498

ANNEX 2
Table 2

KOREA

RURAL INFRASTRUCTURE PROJECT

Gross Investment under the Saemaeul Movement, 1971-74
(Won billion)

Source	1971	1972	1973	1974	Total
Government support					
All Programs	4.1	4.4	21.5	30.8	59.7
Of Which: Environmental Improvement	(4.1)	(3.3)	(4.8)	(4.8)	(17.0)
Contribution by Villages					
Total	8.1	28.0	76.9	102.0	215.0
Of Which: Environmental Improvement	(8.1)	(28.0)	(36.3)	(25.6)	(98.0)
Grand Total	12.2	31.3	98.4	132.8	274.7
Of Which: Environmental Improvement	(12.2)	(31.3)	(41.1)	(30.4)	(115.0)

1/ Includes loans and voluntary labor contributions.

KOREA

RURAL INFRASTRUCTURE PROJECT

Labor Contributions for Various Saemaeul Projects (1971-1974)
(man-days)

Type of Project	Per Household				Per Village				Per cent			
	Basic	Self-help	Self-reliant	Average	Basic	Self-help	Self-reliant	Average	Basic	Self-help	Self-reliant	Average
Village roads	8.0	10.0	17.7	12.6	795	902	1,556	1,163	38.0	34.4	30.3	32.4
Farm feeder roads	3.2	7.1	12.1	8.0	320	644	1,066	731	15.3	24.5	20.8	20.4
Small bridges	1.7	2.5	4.1	2.9	172	224	356	267	8.2	8.5	6.9	7.5
Repair of streams	1.1	0.8	3.2	1.9	106	74	280	177	5.0	2.8	5.5	4.9
Repair of brooks	0.2	1.1	3.8	2.0	24	96	337	182	1.2	3.7	6.6	5.1
Paddy rearrangement	0.1	-	0.8	0.4	7	-	56	27	0.3	-	1.1	0.8
Straw products	1.4	0.9	3.2	2.0	138	81	278	188	6.6	3.1	5.4	5.2
Reforestation	1.1	2.3	2.6	2.0	113	211	227	187	5.4	8.0	4.4	5.2
Improvement of roofs	4.2	4.4	11.1	7.2	419	394	974	663	20.0	15.0	19.0	18.5
All projects	21.2	29.0	58.6	39.0	2,094	2,626	5,130	3,585	100.0	100.0	100.0	100.0

ANNEX 2
Table 4

KOREA

RURAL INFRASTRUCTURE PROJECT

Minor Irrigation Component

The Irrigation Sub-Sector

1. A brief summary of the role of agriculture in the Korean economy and the Government's policy of achieving self-sufficiency in the staple grains, rice and barley, is given in Annex 15. The development of irrigation has played, and will continue to play, a major role in the expansion of rice production during the summer season and of barley as a winter crop. Up to 1962, the total irrigated area was about 660,000 ha or 53% of the total area grown to paddy (1,220,000 ha). Since 1962, new areas put under irrigation varied from 10,000 ha to 70,000 ha per year, with an average of 34,000 ha per year. By 1975, the total irrigated area had risen to 1,100,000 ha or about 86% of the total paddy area (1,280,000 ha). However, not all irrigated areas have adequate water supplies.

2. Over the last six years, the total investment in irrigation construction has varied from Won 10 billion to Won 40 billion per year. Until 1970, investments were shared fairly equally between Central Government (medium and large) projects and Provincial (small) projects. Since 1970, major projects (assisted by external funding) have tended to predominate and funding for Provincial projects (that is, those less than 50 ha) has dwindled. Major projects include the Pyongtaek-Kumgang Project of 30,000 ha (assisted by Loan 600-KO), the Yong San Gang (Stage I) Project of 33,000 ha (Loan 795-KO/ Credit 283-KO), the Kyongju Tourism Project (Loan 953-KO), which includes a small irrigation component, the Imjin Project of 10,000 ha (financed by the Asian Development Bank) and the Sapkyocheon and Gyewhado Projects of 18,000 and 2,600 ha, respectively, financed with assistance from Japan. Several other large projects are in various stages of preparation.

3. Since 1974, USAID has been providing assistance for the completion of 66 medium-sized irrigation projects (from 200 ha to 6,000 ha in size), benefitting a total area of 49,500 ha (average size of project, 750 ha). US$23.7 million has been loaned by USAID to finance heavy equipment for construction. Of the 66 projects, 21 were completed in 1974 and another 26 were expected to be completed in 1975. However, mostly because of price escalation, about US$18 million remains to be found to complete the 66 projects initially included.

The Minor Irrigation Component

4. The project component comprises 66 small or medium-sized irrigation sub-projects covering about 13,500 ha, or an average project size of 200 ha.

About 65% (43 sub-projects) would use small reservoirs, 22 sub-projects would use pumping stations on perennial rivers, while the remaining sub-project is based on a diversion weir. A full list of sub-projects is given in Table 1 and their Provincial distribution is summarized in Table 2.

5. The planning of the minor irrigation component was based on a survey made in 1968 by the Agricultural Development Corporation (ADC). This survey identified about 4,000 sites where minor irrigation would be technically feasible, comprising a total irrigable area of 207,000 ha. Of these projects, some have been built, some have been included in the USAID project (para 3) and another 90 or so have reached the stage of final design.

Sub-Project Selection

6. Sub-projects have been selected for inclusion in the project on the basis of technical and economic factors. Where feasible, priority has been given to sub-projects for which designs have already been completed, so as to minimize the time needed to prepare the project. The following technical criteria were used to eliminate infeasible reservoir sub-projects:

(a) Sub-projects should be greater than 50 ha but less than 700 ha in size;

(b) Dams should be less than 30 m in height;

(c) The ratio of the catchment area to the irrigated area should be at least 2.5:1;

(d) The reservoir live storage should be at least 3,500 m^3/ha irrigated; and

(e) The ratio of the reservoir storage to the embankment volume should be at least 5.0:1.

7. The lower limit on sub-project size is to simplify the administrative arrangements for the project (as projects under 50 ha come under the Provincial jurisdiction) and to take advantage of economies of scale. The upper limit of 700 ha reflects uncertainty over the reliability of the standardized design methods used for larger projects, particularly for reservoir volume and spillway capacity determination (para 15), and also the difficulty of fitting larger sub-projects into the short project implementation schedule. Criterion (b) was introduced so that standardized design methods could be used without the need for individual feasibility studies for particular sub-projects. Criteria (c) and (d) are based on the results of the UNDP study (para 15) and give a reasonable probability of filling the reservoir each year and an approximate measure of the minimum storage requirement for paddy growing. Criterion (c) was reduced to 2.2 in a few cases where additional storage is provided. Criterion (e) is intended to ensure that only damsites with a reasonable storage potential are considered. It should be emphasized that these limits are <u>not</u> design criteria. Sub-projects are being

designed according to the standards described in paras 11 to 14. However, these methods, being standardized, sometimes lead to anomalous results and the above criteria are intended to strengthen the assurance that the water supply for each sub-project will be adequate and reliable.

8. For weirs and pumping stations, the technical criteria employed were that the catchment area should be at least 150 times the benefitted area and there should be no harmful effects on flooding conditions or on other irrigation projects downstream.

9. On the economic side, approximate rates of return have been calculated by ADC for each sub-project, using simplified assumptions about cropping patterns, yields and prices. As there are considerable variations between sub-projects in the pre-project production and the amount of upland to be converted to paddy fields, a simple ranking by capital cost per ha would be misleading. ADC has the services of a USAID advisor in project planning and evaluation to assist in this work. While the results of the ADC analysis have had to be refined for the overall analysis of the component, shown in Annex 17, it was found to be an adequate means for indicating the relative priorities of sub-projects and for selecting the most worthwhile for financing at this time. Thus, following the application of the technical criteria described in para 7, the sub-projects with the lowest rates of return were eliminated until the remaining list could fit within the available budget.

10. General criteria for sub-project selection include the agronomic potential of the area, the need to maintain a balanced investment program among the Provinces and the past record of the potential beneficiaries in self-help activities under the Saemaeul Movement. Unlike most Saemaeul projects, irrigation schemes usually serve more than one village (typically one to 10 villages) and thus the usual mechanism for determining priorities within the village, described in Annex 2, are not entirely appropriate for this component (or for the upland reclamation component). However, the potentially irrigable areas are known to the villagers and they do have means (particularly the Farmland Improvement Associations (FLIA's)) to make their views known to the project planners. Thus, public pressure is also a factor in sub-project selection.

Design Standards

11. About 65% of the irrigation sub-projects, accounting for 78% of the total cost, involve the construction of small earth dams, generally of less than 20 m height. Typically, a clay core and a cut-off trench are used to ensure impermeability, sand is used for filter zones and drains and relatively unselected local materials are used for the upstream and downstream shells. Due to the high cost of crushed rock in most areas, rock is normally used only for riprap on the upstream slope. In most cases, a gated concrete overflow spillway is located on one abutment and irrigation water is diverted through a pipe outlet through the dam controlled by a slide gate. Hundreds of similar small dams have been constructed in Korea during

the last 20 years and are presently well maintained. 1/ The results of this experience have been incorporated in standardized design methods and handbooks and thus no major technical problems are expected in designing and constructing this type of dam. However, some hydrologic problems remain (para 15 and Annex 9). Pumping stations and weirs have also been constructed at many sites and adequate standard methods of design have been evolved.

12. Of the total of 66 sub-projects, final designs are available for 52 and ADC plans to complete designs for the remaining 14 by the end of January, 1976. Some of the existing designs were completed some years ago and required updating. Sub-projects for which large changes in land use have occurred since the design was prepared or for which land acquisition would be prohibitively expensive have not been included in the project.

13. The project works normally include the water source, the main and lateral canals and rough levelling of upland areas to be converted into paddies. On-farm works, such as minor ditches and drains, and fine levelling of converted uplands would be undertaken by the farmers themselves. There is ample evidence that farmers in Korea are willing to carry out the needed on-farm works, usually by manual methods. In many cases a system of ditches for directing local runoff into the paddy fields already exists and this would be upgraded into the minor canal system. Most of the sub-project areas would be too small to require, or benefit from, Government-sponsored paddy rearrangement (land consolidation) schemes and these are therefore not included in the project. However, some of the larger sub-project areas may be suitable for paddy rearrangement at a later date.

14. Sub-project planning is based on 1:3,000 scale contour maps developed from 1:15,000 scale aerial photographs, together with ground control. The reservoir area is mapped at 1:1,200 with cadastral information, to allow land acquisition to proceed. After the design has been approved by the MAF, FLIA personnel negotiate with the landowners for the necessary right of way, using Government estimates of land value. If an owner does not agree to the offered price, compulsory acquisition procedures are begun. In such cases, three to four months is required before construction can begin and six months are needed for the process to be completed. Land acquisition proceedings for the selected sub-project areas began in mid-1975.

Water Requirements

15. It has been computed by the UNDP/FAO Upland Development and Watershed Management Project (AGL/ROK 67/522) that the total irrigation water requirements for paddy in Korea would be around 7,000 m^3/ha in an average year and around 8,200 m^3/ha in a drought year. The same study has shown that the optimum reservoir capacity should amount to about 3,500 to 4,000 m^3/ha. While the available evidence suggests that these criteria are approximately correct and probably on the conservative side, they take no

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1/ There are ten dams in Korea over a thousand years old, which are still in use, including one built in 330 A.D.

account of local variations in weather patterns and rainfall-runoff relationships. Further investigation of these questions, using modern hydrologic methods, would be warranted to produce design criteria to be applied in specific localities and such studies have been included in the project (Annex 9). Revision of the design methods could result in cost reductions in many cases, though the results of the hydrologic studies would not be available in time to benefit the present project.

Organization and Management

16. The Ministry of Agriculture and Fisheries (MAF) would have overall responsibility for the planning and execution of the minor irrigation component of the project. A somewhat simplified organization chart of MAF is shown in Figure 1. The Farmland Bureau of MAF was responsible for sub-project selection. MAF also gives technical guidance to the Agricultural Production Bureau in each Province, which includes a Farmland Section, and the Farmland Sub-section in each county. These Provincial and county agencies, in turn, supervise the Farmland Improvement Associations (FLIA's).

17. FLIA's have been established in nearly every county of Korea, under the Rural Modernization Promotion Law of 1969, to construct and operate farmland improvement works, which are mainly irrigation systems. Although, in a formal sense, the FLIA's are voluntary associations of farmers, they are under close supervision by the Provincial administrations, which appoint the FLIA chairmen, and are under the indirect supervision of the MAF. Each FLIA is headed by a chairman and two inspectors. The 127 FLIA's manage areas ranging from 200 to 40,000 ha and aggregating 434,000 ha (34% of all paddy area). The FLIA's have a total of 657,000 members and 3,700 employees. Under the project, the FLIA's would award contracts, pay contractors from funds forwarded from the Central Government and the NACF (Annex 14), and operate and maintain sub-projects after their completion.

18. Technical services to the MAF in project planning and to the FLIA's in project execution would be provided by the Agricultural Development Corporation (ADC), a semi-autonomous public corporation, supervised by MAF. ADC is headed by a President, a Vice-President, a Director of Farmland Expansion and Development (with the rank of Vice-President) and four Directors. As shown in Figure 2, ADC is divided into seven departments, a special Farmland Expansion and Development Corps (Annex 4), eight project offices, and eight branch offices for irrigation and four for farmland expansion.

19. Under the project, ADC would be responsible for surveys, preliminary and final designs and construction supervision of irrigation sub-projects through its Survey and Design Department and its (Provincial) Branch Offices, respectively. ADC has a sufficient number of experienced engineers to supervise the proposed program of works. At the end of each year, and upon completion of each contract, a work performance appraisal would be made by an engineer designated by the MAF. ADC would rent construction equipment from its machinery pool to those contractors lacking certain pieces of equipment but such renting is expected to be used on only a minor proportion of the works to be constructed.

20. A flow chart showing the relationships between the various agencies involved in minor irrigation (and upland reclamation) is given in Figure 3.

Sub-Project Implementation

21. In all cases, construction would be by contract, with the basic materials (cement and reinforcing steel) being supplied by the FLIA's to the contractor. The quantities of basic materials are given in Annex 11. Implementation of the program of 66 sub-projects would take about two years, assuming all designs are completed on schedule and all contracts are let early in 1976. However, some spillover into 1978 has been assumed in drawing up the Schedule of Expenditures (Annex 12).

Operation and Maintenance

22. Operation and maintenance (O & M) of the main facilities (dams, pumping stations, weirs and main canals) would be carried out by the FLIA's. Estimated costs (in early-1976 prices) are shown below:

			Cost of O & M	
			Won/ha	US$/ha
Reservoir	-	Less than 300 ha	27,800	57
	-	300 to 1,000 ha	25,600	53
Pumping Station	-	Less than 300 ha	37,400	77
	-	300 to 1,000 ha	34,600	71

The above costs include the cost of administrative and extension services provided by the FLIA's (Annex 16). In comparison with other Asian countries, these costs are rather high, but appear to be reasonable, given the small size of sub-projects, the generally high standard of maintenance and the relatively high prevailing wage rates. Cost recovery charges are described in Annex 14 and analyzed in Annex 22.

Environmental Effects

23. The development of irrigation would probably increase slightly the incidence of water-associated diseases. However, it is understood that, except in some places in the extreme south coast, malaria is not present in Korea. Schistosomiasis is also not present. Encephalitis and gastro-enteritis could be slightly increased but the concurrent development of sanitary village water supply systems under the project (Annex 7) would tend to minimize any ill effects of the irrigation component on public health.

24. On the beneficial side, drainage would be improved under the project and the formation of reservoirs and new paddy lands would reduce flood peaks and sheet erosion and would result in less siltation of the rivers downstream and, consequently, lessen flooding and streambed aggradation problems for the lower lands.

KOREA

RURAL INFRASTRUCTURE PROJECT

List of Minor Irrigation Sub-Projects

Identification Number	Province	Sub-Project Name	Water Source	Irrigable Area (ha)	Status of Design 1/ (Yes or No)	Sub-Project Cost 2/ (Won million)
	REGION I					
2	Gyeong-gi	Yong Dam	Dam	254	N	514
4		Ma Ji	Dam	300	Y	482
5		Dai San	P.S. 3/	321	Y	440
7		Sam San	Dam	370	Y	691
8		Weong Dang	P.S.	335	Y	202
9		Han San	Dam	585	Y	1,122
10		Gang Sang	P.S.	329	Y	372
11		Hag Gog	P.S.	159	Y	191
12		In San	Dam	100	Y	351
14		Dae An	P.S.	430	Y	563
15		Gug Hwa	Dam	175	Y	428
16		Gi San	Dam	300	Y	423
17		Geum Ju	Dam	121	Y	328
22	Gang-weon	Og Gye	Dam	246	Y	723
23		Jeong Yeon	P.S.	240	N	199
24		Chu Dong	Dam	96	Y	320
25		Nam Pyeong	P.S.	123	Y	136
27	Chungcheong	Mun Gwang	Dam	270	N	732
29	Bug	Mai Jeon	Dam	120	Y	335
30		Eom Jeong	Dam	700	Y	1,350
31		Han Gye	Dam	202	Y	287
32		Do Weon	Dam	124	Y	202
33		Ha Dang	Dam	80	Y	204
34		Ga Heung	P.S.	211	Y	264
	REGION II					
36	Chungcheong	Gwang Cheon	Dam	258	Y	819
39	Nam	Deog San #2	Dam	95	Y	261
40		Seo San	Dam	349	Y	489
41		Gi San	Dam	213	Y	616
42		Wa Yong	P.S.	88	Y	97
43		Hyun Bug	P.S.	292	Y	308
44		Dai San	Dam	113	Y	301
45		U Mog	Dam	397	Y	908
46		Dai Sul	Dam	546	Y	1,509
47		Song Hag	P.S.	249	Y	241

1/ Indicates whether final design completed (at date of printing).
2/ In early-1976 prices.
3/ P.S. = Pumping Station.

Identification Number	Province	Sub-Project Name	Water Source	Irrigable Area (ha)	Status of Design[1] (Yes or No)	Sub-Project Cost[2] (Won million)
50	Jeonra Bug	Su Dong	Dam	120	N	101
51		Wan Ju	Dam	402	N	496
54		Goe Mog	Dam	113	Y	225
56		Sam Ga	Dam	88	N	189
57		Deog San	Dam	300	N	486
59		Su Dong	Dam	165	Y	304
61		Yu Deung	P.S.	58	Y	90
63		Hwa Yang	Dam	75	Y	269
64		Hwang Geum	Dam	101	Y	368
65	Jeonra Nam	Dal Seong	Dam	90	N	189
69		Il Ro	Dam	496	N	392
73		Nam Pyeong	P.S.	190	Y	220
	REGION III					
75	Gyeongsang	Jeo Pyeong	Dam	108	N	108
76	Bug	Nai Chon	Dam	90	Y	402
77		I An	P.S.	104	Y	196
78		Bo Gyeong	Weir	52	N	93
79		Dai Dong	P.S.	152	N	157
80		Og San	P.S.	130	Y	242
81		Chung Hyo	P.S.	282	Y	447
82		Mai Gog	Dam	80	Y	237
85		O Ro	Dam	383	Y	681
86		Yeon Gyong	Dam	80	Y	274
87		Jin Jul	P.S.	119	Y	141
88		Og Gwan	Dam	130	Y	463
97	Gyeongsang	Sa Cheon	Dam	130	Y	251
100	Nam	Du San	Dam	102	Y	286
102		In Bo	Dam	87	Y	249
103		So Mun	P.S.	68	Y	121
104		Hwa Sim	P.S.	72	Y	117
105		O Cheon	P.S.	150	N	577
106		Hwa Jai	P.S.	146	Y	275
109		Bong Eoi	Dam	58	N	251
	Summary:	Dams :	3	9,212		19,614
		P.S. :	2	4,248		5,596
		Weir :	1	52		93
		Total :	66	13,512		25,303

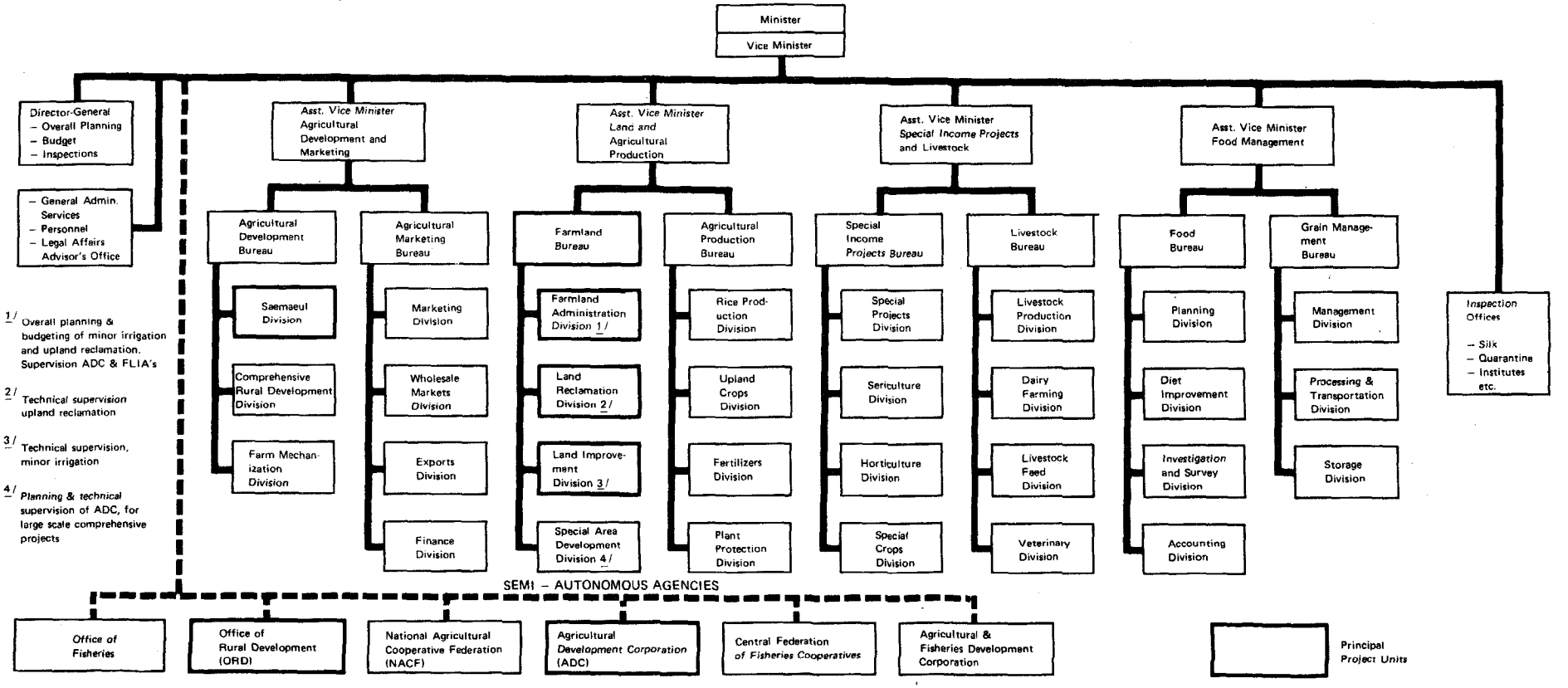
KOREA

RURAL INFRASTRUCTURE PROJECT

Provincial Distribution of the Minor Irrigation Component

Province	Number of Sub-Projects	Irrigable Area (ha)
REGION I		
Gyeong-gi	13	79
Gang-weon	4	705
Chungcheong Bug	7	1,707
Sub-total	24	6,191
REGION II		
Chungcheong Nam	10	2,600
Jeonra Bug	9	1,422
Jeonra Nam	3	776
Sub-total	22	4,798
REGION III		
Gyeongsang Bug	12	1,710
Gyeongsang Nam	8	813
Jeju	-	-
Sub-total	20	2,523
Total	66	13,512

KOREA
RURAL INFRASTRUCTURE PROJECT
MINOR IRRIGATION AND UPLAND RECLAMATION COMPONENTS
Organization Chart of the Ministry of Agriculture & Fisheries (Simplified)



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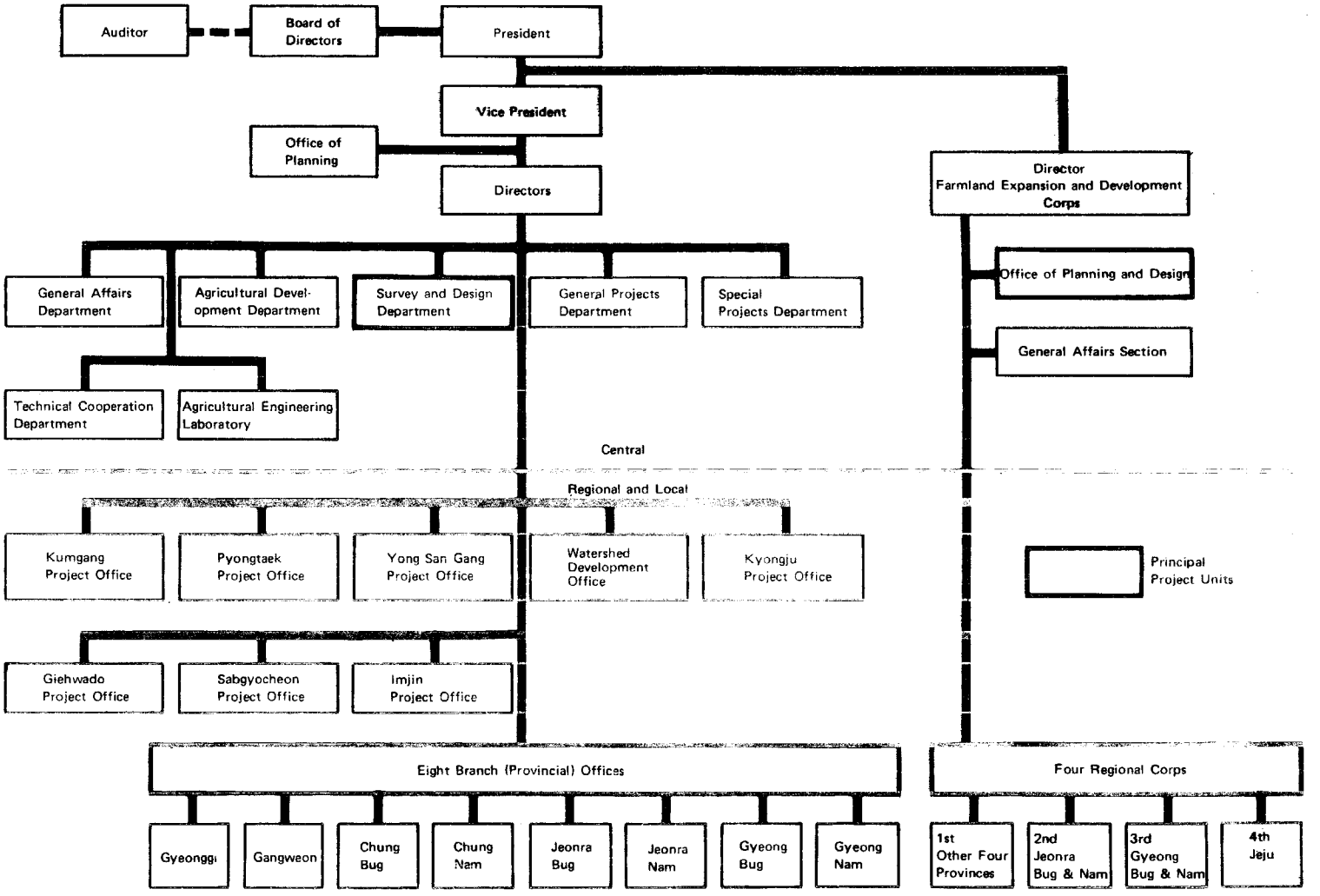
ANNEX 3
Figure 1

KOREA
RURAL INFRASTRUCTURE PROJECT
MINOR IRRIGATION AND UPLAND RECLAMATION COMPONENTS
Organization Chart of the Agricultural Development Corporation (Simplified)



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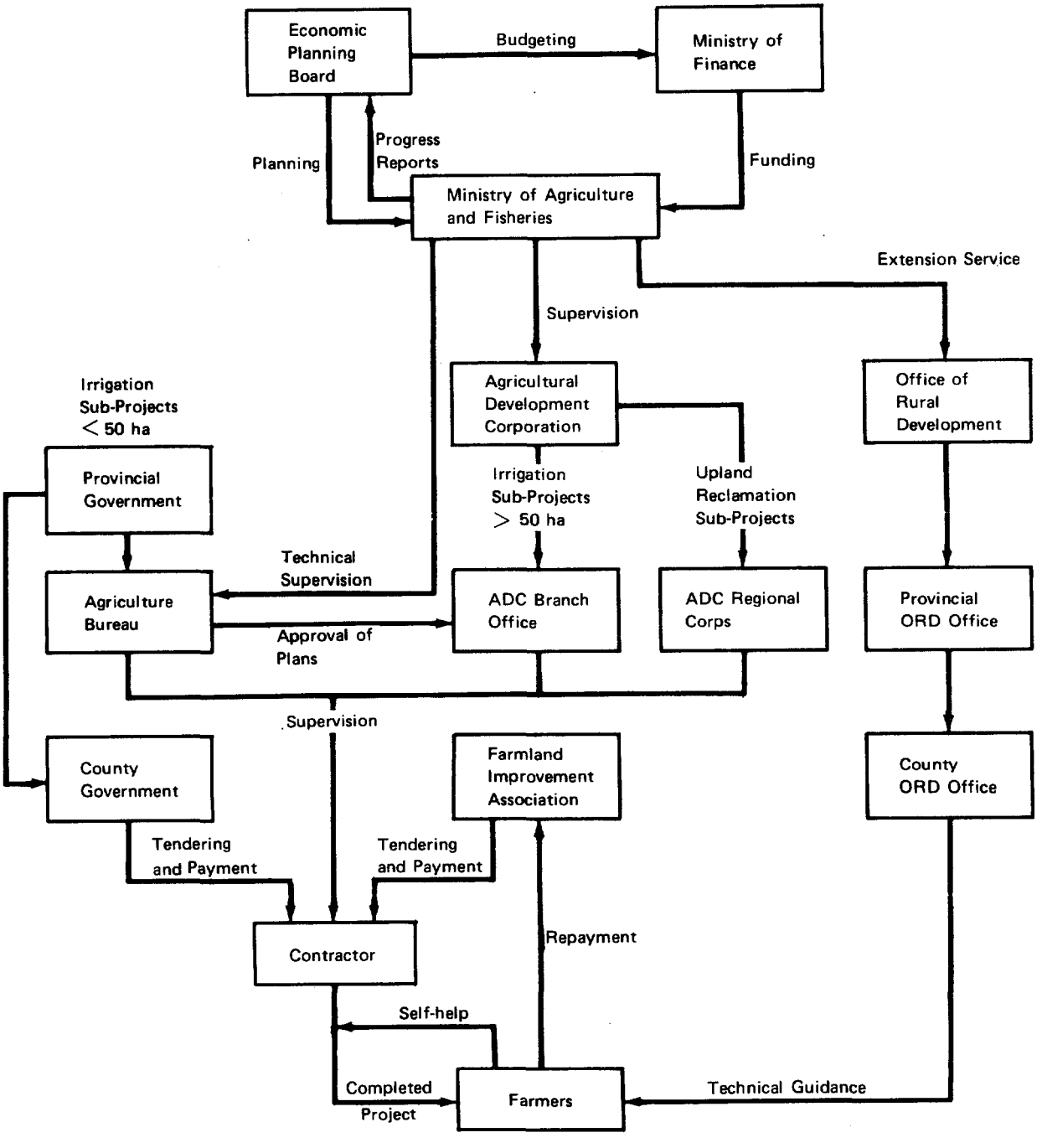
ANNEX 3
Figure 2

KOREA
RURAL INFRASTRUCTURE PROJECT
MINOR IRRIGATION AND UPLAND RECLAMATION COMPONENTS
Project Implementation Diagram



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KOREA

RURAL INFRASTRUCTURE PROJECT

Upland Reclamation [1/]

Background

1. Upland refers to all cultivated or cultivable land other than levelled rice paddies. Uncultivated sloping lands are classified as "forest" (Annex 1). The total cultivated upland area in Korea is 1.0 million ha, most of which has been developed by private initiative. In the late 1950's, the Government became interested in upland development, as a means of providing employment and of settling part of the large number of refugees resulting from the Korean War. Land was given to those who worked (at less than market wages) on its development. This program, the "National Construction Service" (Annex 2), was financed by PL480 foodgrain aid from the United States and reached its peak in the 1962-66 period, when a total of 110,000 ha were developed. Since 1967, Government support for upland development has been modest. However, the need to reduce food imports (Annex 15), to compensate for farmland lost to urban development, and to meet an increasing and more diversified consumer demand for agricultural products, has led the Government to embark on an ambitious five-year program (1975-80) for upland reclamation.

2. A Farmland Expansion and Development Promotion Law was enacted in 1975, which gives the Government broad powers to designate "reclamation areas" and to carry out the necessary development works, whenever the farmers are financially unable to do so. A Farmland Expansion and Development Corps (FEDC) has been created within the Agricultural Development Corporation (ADC) to plan, design and supervise the execution of "reclamation" projects, which include tidal land reclamation as well as upland development (para 17).

3. The ultimate potential for further upland development in Korea has been estimated by ADC as 220,000 ha and present plans call for 112,000 ha to be developed by 1981, or a rate of about 20,000 ha/yr. As the cost of development is about US$2,000/ha (Annex 10, Table 3), this target represents an expenditure of about US$40 million per year. However, as the results of previous upland development have not been entirely satisfactory (para 4) and the remaining areas will be inherently more difficult to develop, the Government is examining closely its design and construction methods and intends to proceed cautiously for the first few years.

1/ Detailed guidelines for this component are given in Reference 1.

4. No comprehensive evaluation of the large development program of the early 1960's has been made but it appears that its results were somewhat disappointing. Some areas were later abandoned and others have suffered from severe erosion. The main causes appear to have been the following:

(a) Settlers were given upland only (no paddy land) and thus were completely at the mercy of the weather and were not able to take advantage of the Government's policy of high rice prices;

(b) The developed areas were relatively remote. Only minimal access was given and little social infrastructure was provided. The settlers therefore found it difficult to establish viable communities;

(c) Technical standards of upland development were sometimes inappropriate, leading to deterioration of the works and severe soil erosion; and

(d) Little technical guidance was available to the farmers on how to maintain soil fertility and prevent erosion.

On the other hand, many of the uplands developed by private initiative, particularly those in areas of fertile soils and goods access to markets, have been clearly successful.

Constraints on Development

5. Soil Fertility - Korean upland soils are rather highly leached and low in organic content and cation exchange capacity. They are therefore moderately to highly acid, the pH being less than 5.5 on more than half the soils. This condition can be corrected with heavy applications of lime and fertilizer. Although both these inputs are heavily subsidized by the Government (Annex 15), lack of access is often a constraint on applying the heavy doses needed (for example, 4.5 ton/ha of lime).

6. Slope - Traditionally, upland development was concentrated on the lower slopes (5 to 15%) but future programs will have to deal with much steeper gradients (10 to 35%). Given that soil depth tends to decrease and coarseness to increase as the slope steepens, the water holding capacity in the root zone may be a serious constraint on cropping.

7. Climate - The quantity and regularity of rainfall vary throughout Korea and, for example, may restrict the development of soils of low water holding capacity in the Southern Region. Lack of sunlight may limit the development of north facing slopes.

8. Erosion - Rainfall, soil, vegetation and topography all affect the rate of erosion but, despite the fact that erosion is generally recognized as a major national problem and the Government is spending large sums to overcome it, there has been little research on the characteristics of rainfall

intensities (Annex 9) or on the inherent erodibility of various soils. Erosion prevention has been given too little attention in past development and lack of basic knowledge is seriously hampering the design of future soil conservation works.

Past Practices in Upland Reclamation

9. Upland development to date can be classified into three categories:

(a) Contour cultivation of row crops;

(b) Bench terraces, where the land is converted to a "staircase" of near-level benches, with grassed risers between the cultivated benches; and

(c) Semi-bench terraces, where the slope within the bench is reduced to between 5 and 8%.

In the past, each conservation practice has been used widely. The more intensive practice (bench terracing) has generally been used on the steeper slopes and also in areas where higher-value crops are grown.

10. A considerable amount of data on the costs and benefits of upland reclamation was generated by two UNDP/FAO Projects: "Agricultural Survey and Demonstration Watersheds Project" (ROK 7)(1962-67); and "Upland Development and Watershed Management Project" (ROK 67/522)(1967-73). Under these projects, several hundred ha of uplands were developed, bench terracing being used almost exclusively. The UNDP projects did not attempt to compare alternative conservation practices but rather concentrated on optimising the design and construction procedures for the selected practice, within the watersheds in which they operated.

11. The FEDC uses slope as the main design criterion and previously recommended only variations of the contour cultivation method. Designs were based on the Universal Soil Loss Equation, which combines a number of empirical factors which, given the lack of research data in Korea, must be estimated. The results of this method, therefore, are likely to have a large margin of error. Under the project, a more flexible approach would be adopted (para 14) and research would be carried out and the results fed back into the design process (para 20).

The Upland Reclamation Component

12. Sub-project selection (para 13) was underway at the time of printing and will not be finalized until after the appointment of the proposed upland reclamation adviser (para 19). The following description of the characteristics of the sub-projects is therefore rather general. The component would include about 35 sub-projects, having a gross area of 4,500 ha. The sub-projects would therefore average 130 ha, on a net basis. In order to avoid small, isolated developments, which have not been successful in the past (para 4), FEDC has adopted a minimum sub-project size of 50 ha. Sub-projects

would probably be concentrated in Gyeong-gi and Chungcheong Nam Provinces, as they have the largest potential for development, in the form of foothill areas adjacent to central mountain range. The sub-project areas are presently owned in small parcels by local villagers (Annex 1).

Sub-Project Selection

13. Project initiation is described in para 18. Sub-projects are being selected from a list of 83 potential sub-projects using the following criteria:

(a) Regional distribution - sub-projects are being selected approximately in proportion to the provincial distribution of the land available for development, while attempting to cover a reasonable range of topographic and soil conditions;

(b) Profitability - the potential for cash crops is an important criterion and only sub-projects with a potential for high-value crops (red pepper, fruits and vegetables) on at least one-third of the area have been included;

(c) Farm Size - farm budget analysis (Annex 18) shows that only small farms which can be intensively cropped and operated by the family's own labor and animal power are likely to be financially viable. In general, sub-projects have been selected so that the average total farm size (including existing area) does not exceed 1.5 ha. In cases where this criterion is exceeded, special attention will be given by the project management to the needs of the beneficiaries for inputs, hired labor and credit; and

(d) Accessibility - except in extenuating circumstances, access roads would be included to the degree that:

(i) at least 60% of the new upland plots would be located within 500 m of the village and not more than 20% would be located more than 1,000 m distant;

(ii) all villages would be accessible by truck;

(iii) at least 30% of the upland area would be accessible to within 100 m by truck or oxcart; and

(iv) not more than 20% of the upland area would be accessible only by footpath.

Design Standards

14. The proposed design standards are summarized in Table 1. Selection of the appropriate conservation practice for a sub-project or portion of a sub-project would begin with the cropping potential (taking into account access, marketing and other factors, in addition to agronomic potential) and then look at soil fertility, erodibility, depth and water holding capacity, slope and topography, and climatic constraints. Unlike FEDC's past practice, slope would not be a primary design criterion. Except for pasture development, contour farming would be used only on soils of low erodibility and high water holding capacity. Semi-bench terraces would be used on soils of shallow depth but medium to high fertility and water holding capacity and low to medium erodibility. Bench terraces would be used in all other cases. While the proportions of each treatment will not be known until detailed surveys (para 15) have been made, the following figures have been used for cost estimating:

Contour farming	-	20%
Semi-benching	-	25%
Bench terracing	-	55%

Application of these criteria would require close coordination between FEDC's engineering and soils/agronomy staff.

Design and Construction Procedure

15. For each sub-project, a preliminary design would be made on a 1:1,200 map. The development area would then be cleared and smoothed to allow a detailed survey and mapping at 1:600 to be made, including mapping of soil characteristics, such as texture, erodibility, water holding capacity and fertility. This would allow the benches, drainage ditches, roads and other features to be laid out much more accurately than present methods permit and would make full allowance for local variations in topography. In order to fit in with the cropping calendar, the construction schedule shown in Figure 1 is proposed. Following completion of the earthworks, lime and fertilizer could be applied and a green manure crop sown, all directed by the project management and charged to the project cost. After plowing under the green manure crop, titles would be issued and the land would be handed over to the farmer.

16. Construction in all cases would be by contract, with cement, reinforcing steel, lime and fertilizer being supplied by the Government. In some cases, ADC would rent construction equipment to successful bidders at standard rates.

Organization and Management

17. The counties would be responsible for implementation of the upland reclamation component but would rely on ADC for technical services. The

functions and organizational structure of ADC are described in Annex 3 and shown schematically in Figure 2 to that Annex. FEDC was created in 1974. Its Director has the rank of Vice-President and reports directly to the President of ADC. Surveys and designs would be carried out by FEDC's head office and construction supervision would be the responsibility of the appropriate regional corps.

18. Project initiation is as follows. Upon request from the villagers, or on the recommendation of the Provincial Government, a reconnaissance survey and a feasibility study are made by FEDC. A basic development plan is then submitted to Farmland Development Committees at the county and Provincial levels. After approval at these levels, the plan is submitted to the Cabinet and President and, if the plan is approved, the area is declared a "Designated Area for Development" and the land owners are notified. Land owners are given 60 days to object to the proposed development. Those doing so are bought out by the Government and the land is leased to another farmer, who is then responsible for repaying the land improvement loan (Annex 14). The above steps have been completed for most of the proposed sub-project areas.

Technical Assistance

19. In order to establish the new design and construction standards for upland reclamation (para 15) and to test them under various topographic and soil conditions, the services of an adviser with broad international experience in soil conservation would be required. As well as advising the Director of the FEDC on the proper design and execution of the project works and on the revision of FEDC's design handbooks, the adviser would also establish and supervise a research program (para 20) and would make recommendations on staff training. The adviser's services would be required for about two years.

Research Program

20. Research would be needed to improve the planning of future upland reclamation projects and to refine and complete the proposed design criteria and construction methods. The main areas of research would be as follows:

(a) Systematic analysis of land development projects. The evaluation studies completed in 1968 by the College of Agriculture, Seoul National University, should be resumed with the following objectives:

- to identify existing upland areas where production is low;
- to study the changing patterns of land use;
- to study the extent to which new upland projects could contribute to agricultural production; and
- to identify factors restricting upland development and fields for future research.

(b) Soil Erodibility Studies

Comparative soil erodibility studies should be carried out using an artificial rainfall simulator.

The major piece of equipment for (b) is available in Korea and has been calibrated. Other equipment would be procured under the project (Annex 11). Research studies would be planned and supervised by FEDC and the soil conservation adviser but specialized work would be done by Seoul National University or the Office of Rural Development (ORD), as appropriate.

Extension

21. As the upland reclamation sub-projects would require a high investment per hectare and their profitability would depend on the farmer's ability and willingness to manage his soil correctly, special extension efforts would be required. These are described in Annex 16.

Operation and Maintenance

22. The small amount of work needed to maintain the access roads, the diversion ditches and other common facilities to be constructed under the project would be provided collectively by the farmers concerned. Maintenance of bench terraces and other privately owned facilities would be undertaken by the owners. Guidance and supervision would be provided periodically by ADC and ORD.

Environmental Effects

23. Provided adequate development criteria are adopted and rigorously enforced and provided that the project works are properly designed, implemented and maintained, there should be no significant increase in erosion and siltation. In many cases, runoff would be retarded by the bench terraces and thus flooding would be reduced.

KOREA

RURAL INFRASTRUCTURE PROJECT

Design Standards for Upland Reclamation

RECOMMENDED PRACTICE	CROP	PREFERRED CONDITIONS								
		Potential Soil Fertility (1)	Inherent Soil Erodibility (2)	Soil depth (cm)	Total water holding capacity (mm)	Slopes	Climatic Zone	Topographic Aspect	Topographic relief	Remarks
Bench Terrace	Orchard (3)	high-medium	high-medium	≥ 75	≥ 100	5-35%	Central Western South Western Southern	South	all conditions	a) Elevation between benches 100-120 cm b) width of benches 3.0 m
	Special Crops (4) Forage	ditto	high-medium	≥ 60	≥ 80	5-35%	Central Western South Western Southern	all aspects	rolling and regularly undulating	a) Elevation between benches 80-120 cm b) width of benches 4.0 m
	Mulberry, Vine	ditto	high-medium	≥ 60	≥ 80	5-35%	Central Western South Western Southern	South	rolling and regularly undulating	a) Elevation between benches 80-100 cm b) Width of benches 2.5 m
Semi-Bench Terrace	Orchards	medium	medium-low	≥ 60	≥ 120	5-25%	Central	South	regular contours preferably parallel	non-cultivation between trees
	Special Crops	ditto	medium-low	50	100	5-25%	Central Western (See note 5) Southern	all aspects	regular contours preferably parallel	May require mulching practices
	Mulberry, Vine	ditto	medium-low	≥ 50	80	5-25%	Central Western (See note 5)	South	ditto	non-cultivation (no intercropping)
	Winter barley - summer grains (6)	ditto	ditto	60	60	5-15%	all regions	all aspects	ditto	
	Spring-fall vegetables (7)	ditto	ditto	60	60	5-25%	Central Western Southern (See note 5)	all aspects	ditto	May require mulching practices
Contour farming (diversion ditches +buffer strips)	Orchards	medium-low	low	100	120	25-35%	Central Western Southern (See note 5)	South	regular parallel contours	non-cultivation between trees
	Special Crops	ditto	ditto	75	100	5-15%	Central Western Southern (See note 5)	all aspects	ditto	requires mulching practices
	Mulberry, Vine	ditto	ditto	≥ 75	100	5-25%	Central Western (See note 5)	South	ditto	No intercropping permitted
	Winter barley - summer grains (6)	ditto	ditto	50 to 70	75	5-15%	all regions	all aspects	ditto	
	Spring-fall vegetables (7)	ditto	ditto	40 to 60	60	5-15%	all regions	all aspects	ditto	requires mulching practices
	Pasture	ditto	low-medium high	30 to 50	40	15-50%	all regions	all aspects	all relief, even rugged	may not require lime and fertilizer applications

Notes

(1) Based on soil series if other data not available

(2) Determined by empirical relationships unless comparative field data available

(3) Orchards: includes apples, peaches, pears

(4) Special Crops: includes winter barley- sesame or red pepper or tobacco or watermelon

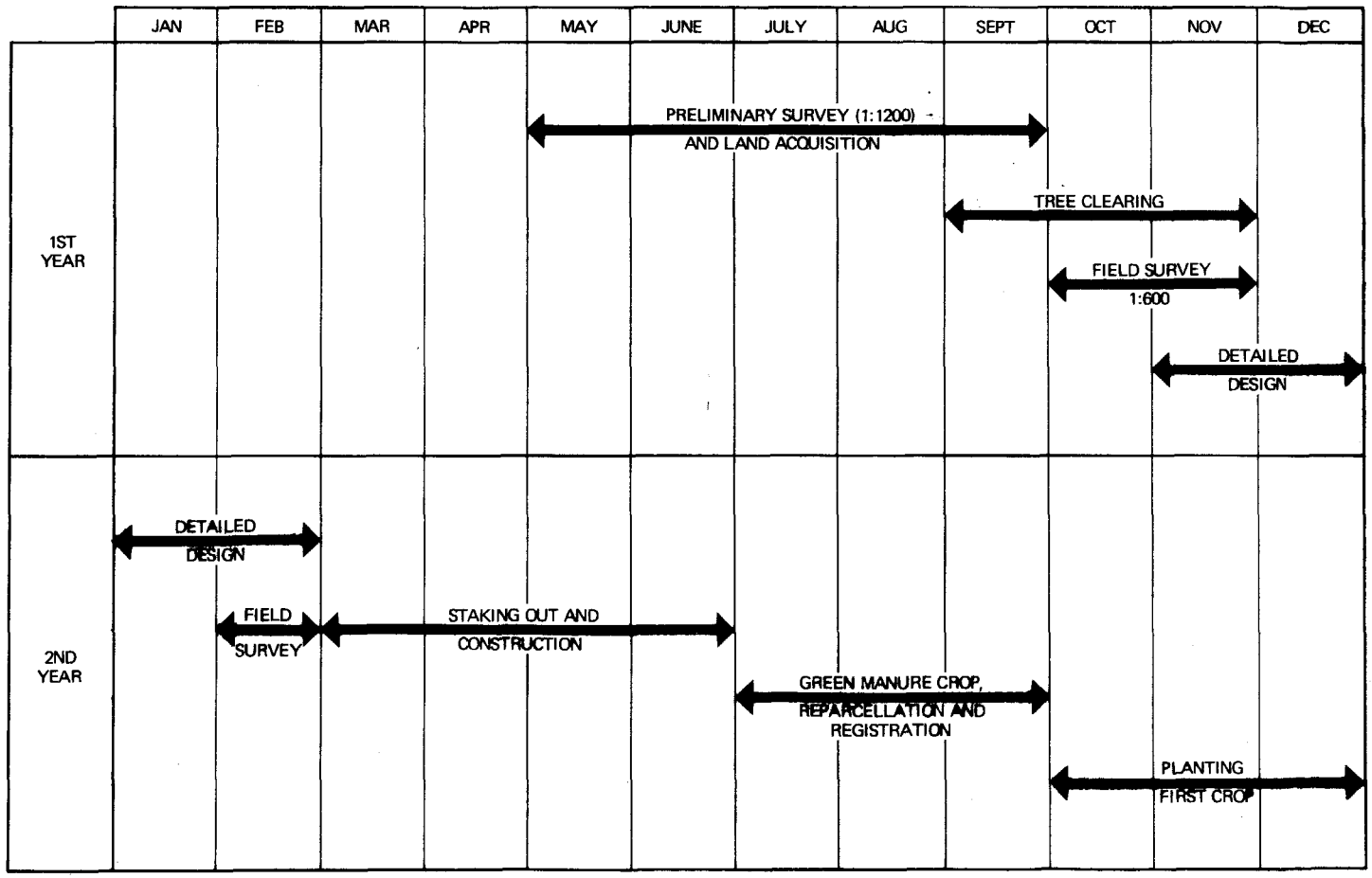
(5) May be applicable to other climatic zones, if rainfall does not limit available soil moisture during growing season or if longer growing season

(6) Alternative cropping practice: Winter barley - soybean

(7) Includes: Winter barley - white potato - chinese cabbage or sweet potatoes

ANNEX 4
Table 1

KOREA
RURAL INFRASTRUCTURE PROJECT
Proposed Design and Construction Schedule



World Bank–15210

ANNEX 4
Figure 1

KOREA

RURAL INFRASTRUCTURE PROJECT

Fuelwood Component

The Forestry Sector

1. Of the land classified as forest (Annex 1), 73% is privately owned, 20% is in National Forests, while the remaining 7% is Public Forest (communally owned). The National Forests are located mostly in Gang-weon Province (Map 10380), which is the more mountainous and sparsely settled part of Korea. Therefore, the proportion of privately-owned forest land is correspondingly higher in the other, largely agricultural, Provinces of the country. The private forest-land holdings are for the most part very small, as shown in Table 1. The average holding size is 2.6 ha but the median size is less than 1 ha, with 96% of the holdings being less than 10 ha in size. Although there are only 2,000 holdings greater than 100 ha, these account for nearly 10% of the private forest area.

2. Private forest-land is used mostly for the gathering of fuel and is therefore usually almost bare of trees or else carries impoverished pines less than 2 or 3 m high. Such land is frequently most valued for its use as a family burial ground. Given the high proportion of privately-owned forest, it is clear that private forest land has to be used for the establishment of village fuel wood plantations. As they are mostly small farmers, the owners are usually not able to bear the cost of planting the land themselves. Under the Forest Development Law of 1973, the Village Forestry Associations (VFA's) are empowered to take over the planting and management of private forest land under an agreement whereby the owner retains the ownership of the land and is entitled to a 10% share of the fuelwood produced from the plantations established upon it. The duration of the contract with the land owner equals the nominal economic life of the species to be planted. This arrangement has paved the way for the formation of compact blocks of land for fuelwood plantations.

The Need for Fuelwood

3. Basic to the forestry problem in Korea is the long period of extreme winter cold, when the mean daily temperature is below freezing for almost three months. The need for protection against the severe cold has led to the development of the "ondol" heating system, in which the flues from the kitchen cooking stoves are led beneath the floors of the living rooms of the house and thence to chimneys on the far side of the house. This under-floor heating system requires large quantities of fuel (averaging 4.2 tons per annum for a household of 6 persons), and in rural areas has led to the almost total impoverishment of those areas of forest land which are adjacent to

agricultural communities. Coupled with this voracious demand for fuel is the fact that all areas of forest land have traditionally been regarded as freely available for fuelwood gathering and, therefore, control has been almost impossible to impose. The problem is further compounded by the fact that the supply of fuelwood is now quite inadequate to meet the demand and thus leaves, grass, and forest litter are raked up for fuel. Rice straw, maize stalks and similar agricultural residues are also consumed in large quantities. The removal of forest litter has led to serious erosion and flooding problems and also to the lowering of soil fertility levels, whilst the use of agricultural residues as fuel deprives the individual farmers of a potential source of income, and the country of valuable raw materials (for composting, thatching and the manufacture of rope and bags).

4. In the past, major efforts were put into national reforestation schemes but these had limited success because of the inability of the forest authorities to control the collection of fuelwood. In many cases, seedlings were cut and removed within six months of being planted. This situation, together with proposed remedies, has been described in several FAO reports on forestry in Korea.

5. Recognizing the seriousness of the problem, the Government introduced early in 1973 the following series of measures:

(a) The Office of Forestry was placed under the Ministry of Home Affairs, thus effectively strengthening its authority, particularly in the field of forest protection. At the same time, the status of the Provincial and County Forestry Offices was increased, and their staffs strengthened;

(b) A strong extension and publicity campaign was mounted, to inform the rural population of the vital necessity of restoring forest cover to the land, and to induce them to adopt the following fuel-saving methods:

(i) Conversion of cooking and heating units to coal burning, where coal supplies are adequate;

(ii) Improvement of the design of cooking stoves, for more efficient conversion of fuel;

(iii) Replacement (under the Saemaeul Movement) of thatched roofs by tile, asbestos, and corrugated iron, thereby reducing the consumption of rice straw for thatching;

(iv) Elimination of the practice of cooking all feed for working oxen; and

(v) The introduction of methane gas producers (using animal manure) and kerosene heaters;

(c) Enforcement of regulations forbidding the raking of leaves, grass and litter within forest areas; and

(d) The introduction of a national reforestation scheme to create a well-managed fuelwood plantation for each village, the reforestation work to be carried out by the villagers themselves.

6. Due, in part, to these new measures, standards of forest management in Korea have been transformed in the last few years. The annual rate of reforestation with fuelwood plantations has now built up to more than 30,000 ha per annum, with newly-established plantations clearly visible in all part of the country. The restoration of ground vegetation, in the absence of litter-raking is also clearly apparent, as is the widespread conversion of roofing to materials other than thatch. The production of transplants has been greatly increased and village production of nursery stocks has been placed on a commercial basis, as an additional source of income to farmers. The fuelwood plantations are well laid out, the survival rates of the planted trees is high, weeding is well maintained, and protection against fire and other forms of damage is good. Nursery stocks, their transport to the planting sites, and the availability of labor for planting are also adequate. There do not seem to be any problems of supervision, either at the technical advisory level or at the village foreman level.

7. Within its national 10-year program to reforest 1.0 million ha of land, the Government is now giving top priority to the creation of village fuelwood plantations on 200,000 ha. As this work is labor-intensive, it is entirely suited to the aspirations of the Saemaeul Movement.

The Fuelwood Component

8. The establishment of village fuelwood plantations, on a total of 127,000 ha in all nine provinces of Korea, is proposed (Table 2). A survey in late-1975 showed that new or supplementary fuelwood blocks were required in about 11,100 villages and this survey is the basis for the proposed fuelwood component. Sub-projects would vary from 3 ha to about 50 ha, the smaller blocks being intended to supplement previously established plantations. The average sub-project size would be 11 ha but one sub-project might contain several separate blocks. While fuelwood production would be the main purpose of the program, about 30% of the trees would be intended primarily for timber production (mainly for local house building and, in some cases, for commercial uses), with fuelwood as a by-product (para 15). The main objectives of the fuelwood component would be as follows:

(a) To stabilize a sustained supply system of fuelwood for the rural areas by the eventual production of 640,000 tons of additional fuelwood annually;

(b) To supply fuel for both forest owners and non-forest owners;

(c) To protect the forest through self-policing by Village Forestry Association members;

(d) To enrich the national forest resource by the planting of timber-producing species, as an admixture to the fuelwood species;

(e) To build the productivity of the remaining forest land through the prevention of litter raking; and

(f) To boost the income of farm households through alternative uses for agricultural by-products.

9. In view of the size and success of the 1975 program (40,000 ha), and the satisfactory establishment and protection of previous years' plantings, the targets of 50,000 ha in 1976, and 77,000 ha in 1977, seem well within practical attainment. Nursery stocks, transport, and technical supervision also appear quite adequate for the proposed program and, most important of all, the program appears to have the full understanding and support of the villagers themselves.

Technical Description of the Fuelwood Component

10. Planting Sites - The sites selected are on moderate to steep land (all other land being given over to agricultural crops), close to the villages. Sites may be either areas classified as "forest", which are preferred for larger plantings, or consist of small pieces of unused "non-forest" land such as roadsides, streambanks, strips adjacent to cultivated land, or risers between bench terraces. As far as possible, communal land is selected for the plantation but, as most forest land is privately owned (para 1), arrangements are made for such land to be taken over by the Village Forestry Association (VFA), whereby the VFA assumes all management responsibilities (including the organization of planting) and the owner receives 10% of the yield of the plantation. The inclusion of timber-producing species (which have a cash value) eases any problems in obtaining the consent of the landowner and, in nearly all cases, there is no need to resort to the powers of eminent domain in the Forest Development Law. In some cases, State Forest land (National Forest) may be made available to the VFA's under long-term lease but such instances are insignificant.

11. Site preparation - In most cases, the areas selected for planting carry only a light growth of shrubs and grass, with a few small and stunted Pines or hardwoods scattered over the area. Clearance is therefore easy and can be carried out with simple hand tools. There is burning before planting and the planting pits, 30 cm in diameter, are made at the time of planting.

12. Seed supplies and nursery stocks - All seeds are produced in Korea. Seed collection is organized by the VFA's. Transplants are produced from a variety of well-organized nurseries, including:

(a) State nurseries;

(b) VFA nurseries at Province, County and Village levels; and

(c) Private commercial nurseries.

The largest production is from the VFA nurseries. Stock from these nurseries is sold at a small profit to cover costs and to give a return to the VFA members.

13. Transport - The country has an adequate road network and therefore primary transport of seedlings by truck is no problem, with secondary distribution being carried out by bullock cart and by human portage. There are no serious problems of access to the plantation areas. Project supervision, by the Office of Forestry and the VFA unions, is presently hampered by a lack of suitable vehicles. Under the project, 140 pick-up trucks, one for each county, would be procured.

14. Planting - Planting takes place in March and April. To obtain maximum early yields, planting density is high, with 4,000 plants/ha being used for "forest" areas, while 10,000 plants/ha are proposed for "non-forest" areas where only low-growing shrubby species (such as Lespedeza) are suitable, owing to the need to prevent shading of adjacent crops. While research results show that these spacings are optimal from a yield point of view, they may not give sufficient weight to cost factors and to soil and site conditions. While the project remains economically sound (Annex 19), given the present density, there may be additional benefits from less dense spacing and therefore various spacings would be field tested under the project. Planting is in straight lines up and down the hillsides, to facilitate weeding and later extraction of the produce. Open-rooted planting is used and NPK fertiliser (at a rate which varies from zero to 80 g per plant, with an average of 6 g) is applied at the time of planting.

15. Species Selection - The selection of a particular species (or species mixture) for an individual site is governed by its location in the country, soil fertility, and other site characteristics. The main fuelwood species used are Black Locust (Robinia pseudoacacia), Alder (Alnus firma and A. hirsuta) and the leguminous shrubs Bush Clover (Lespedeza sp) and Indigo Bush (Amorpha sp). The main timber species are Poplar (Populus alba x glandulosa) and Larch (Larix leptolepis) while Pine (Pinus rigida and P. thunbergii) may be considered dual-purpose. An interesting development is the use of Poplar in alternating lines with Bush Clover on relatively dry mountain sites. This is the so-called "Sunchon" method of fuelwood production. The Lespedeza gives fuelwood in the first year, plus a cash crop from seed production, whilst the Poplar gives fuelwood from the pruning of side branches, and can be grown on to produce pulpwood at nine years old, or saw timber on longer rotations. Wherever site conditions permit, plantations of mixed timber-producing and fuelwood-producing species are created. For example, Poplar (for pulpwood production) is planted with Lespedeza or Robinia. Pinus rigida (for fuel and timber production) may be planted with Robinia on low-quality sites, where the nitrogen-fixing capacity of the Robinia is valuable for site improvement, whilst the Pine is tolerant of the low site quality.

16. While the mixing of fuel and timber-producing species may not be ideal, from an economic viewpoint, there are good sociological reasons for its use. The main timber species are well understood by the villagers and

produce significant amounts of fuel from pruning and thinning. High-yielding fuel-producing species are more novel and may have problems, such as the thorniness of Robinia. Under the project, about 30% of the project area would be planted to dual-purpose species (such as pines), 30% would be devoted to Lespedeza and Amorpha in "non-forest" areas, while the remaining areas would grow Robinia and Alders (Table 3).

17. Maintenance - The plantations are weeded for two or three years after planting, until the trees are free from grass competition. Insect pests pose some problems but control methods are well understood. If necessary, fire breaks are constructed around the plantation. Losses from fire have been low in recent years.

18. Yields - The first yields of fuel are from the cutting of competing shrub growth during the weeding operation (para 17). In the case of timber species and Alder, pruning of side-branches commences at three or four years old, and this forms the main yield of fuelwood throughout the early years of the plantation, later to be replaced by the yield from thinning, and eventually clear-felling. The average annual fuelwood yield varies from 1 ton/ha for poplar to 5.5 ton/ha for alder. Lespedeza can be clear-cut every year for fuel, beginning at the end of the first year, with an average yield of 5 ton/ha. Black Locust can be cut in the second year, as the species will coppice vigorously, and from the fourth year onward an average yield of 10 ton/ha is obtained. In analysing the component (Annex 19), 5.0 ton/ha is taken as the average yield. For the average village, the yield of forest fuels forms only about 50% of its total demand for fuel, the other 50% coming from agricultural residues.

Sub-Project Selection

19. Arising out of the recent survey (para 8), the fuelwood needs of every village have been assessed using a standard Fuelwood Forest Record. Based on the number of households and fireplaces in the village, total fuel demand is calculated. The forest resources of the village are assessed and, based on the availability of suitable land and of alternative fuels (such as coal and kerosene), a judgement is made by the district Office of Forestry staff (para 20) on the size of fuelwood plantation needed. Priority in allocating government staff time and materials to particular villages depends largely on the competence and enthusiasm of the VFA but also on the village's own priorities, as expressed through its Saemaeul Committee. Priority is also given to villages with particularly acute shortages of fuel, which is the reason for the concentration of the program in the more densely populated Provinces (Table 2). These selection criteria are reasonable.

Organization

20. A Village Forestry Association has been formed within every village in the country. The head of each VFA is elected by his fellow villagers for a five-year term. He is directly responsible for organizing the planting program, plantation maintenance and all other activities of the VFA, such as the production of transplants from the village nursery, oak mushroom cultivation, and so on. He obtains technical guidance in his work from the foresters of the VFA Union at county level, and the district officers of the Office of Forestry.

21. The Office of Forestry, and the VFA field organizations, are fully staffed at all levels, with the Office of Forestry having approximately 40 technically-trained foresters in each Provincial Office and 25 in each County Office. These numbers are impressive and represent a very adequate forestry organization for the country.

Research on Fuelwood

22. The Office of Forestry includes a Forest Research Institute and a Forest Resources Survey Institute, the activities of both of which will have a bearing on the success of the reforestation program. Of particular importance is that the Survey Institute is conducting a regular five-year review of Korea's forest areas, by means of aerial photography of the whole country, thus providing a check on the progress and success of the reforestation effort. Research efforts on fuelwood are mainly being directed at harvesting and consumption rates. Further efforts are needed on the following subjects:

(a) Species suitability and new species;

(b) Spacing trials;

(c) Fertilizer trials;

(d) Thinning and pruning trials; and

(e) Optimum age for transplanting.

While existing knowledge is sufficient to establish the feasibility of the proposed fuelwood component, additional research could lead to lower costs and improved efficiency of resource use and thus is essential to the long-term planning of fuelwood production. The Government has recognized this need and is considering the preparation of a major project for forestry research, including fuelwood.

23. Funds would be available under the project (up to US$100,000) to support fuelwood research during 1976-8. These funds would be used for the purchase of vehicles, equipment and materials, and staff training. These funds could also be used for any consultant services which might be needed in the preparation of the Government's proposed Forestry Research Project.

24. The Forest Research Institute includes training facilities. One training program handles short courses for instructing Provincial-level foresters in the type of training and knowledge required by village-level supervisors and foremen. The Provincial staff, through similar courses, then pass the knowledge on the county and district levels, until ultimately the district foresters are able to hold training courses for all village VFA chiefs in their areas. This seems to work well and supervision (and interest) appear to be quite high at the level of the field labor gang, the evidence being in the quality of the work produced.

Environmental Effects

25. Reforestation by fuelwood plantations would improve the environment through a reduction in erosion. It would also enable the surrounding forest lands to recover from their previous over-use for fuel-gathering and become productive and environmentally stable. Even on aesthetic grounds, most of the plantations being established would be mixtures of conifers and hardwoods, thereby avoiding any accusation of the plantations being "regimented lines of somber firs."

ANNEX 5
Table 1

KOREA

RURAL INFRASTRUCTURE PROJECT

Ownership Pattern of Private Forest Land

Holding Size (ha)	Number of Holdings	% of Holdings	Total Area (ha)	% of Area
Less than 1.0	985,000	56.0	387,000	8.4
1.0 - 10.0	699,000	39.7	2,275,000	49.2
10.0 - 100.0	74,000	4.2	1,519,000	32.9
More than 100.0	2,000	0.1	441,000	9.5
Total	1,760,000	100.0	4,622,000	100.0

ANNEX 5
Table 2

KOREA

RURAL INFRASTRUCTURE PROJECT

Provincial Distribution of the Fuelwood Component

Province	No. of sub-projects	Area to be Planted (ha)		
		1976	1977	Total
Gyeong-gi	1,220	2,400	7,000	9,400
Gang-weon	943	2,300	7,000	9,300
Chungcheong Bug	897	3,400	5,000	8,400
Chungcheong Nam	1,674	8,100	7,900	16,000
Jeonra Bug	1,077	4,400	7,000	11,400
Jeonra Nam	2,240	10,100	15,000	25,100
Gyeongsang Bug	1,796	8,600	14,000	22,600
Gyeongsang Nam	1,231	10,200	13,600	23,800
Jeju	51	500	500	1,000
Total	11,129	50,000	77,000	127,000

KOREA

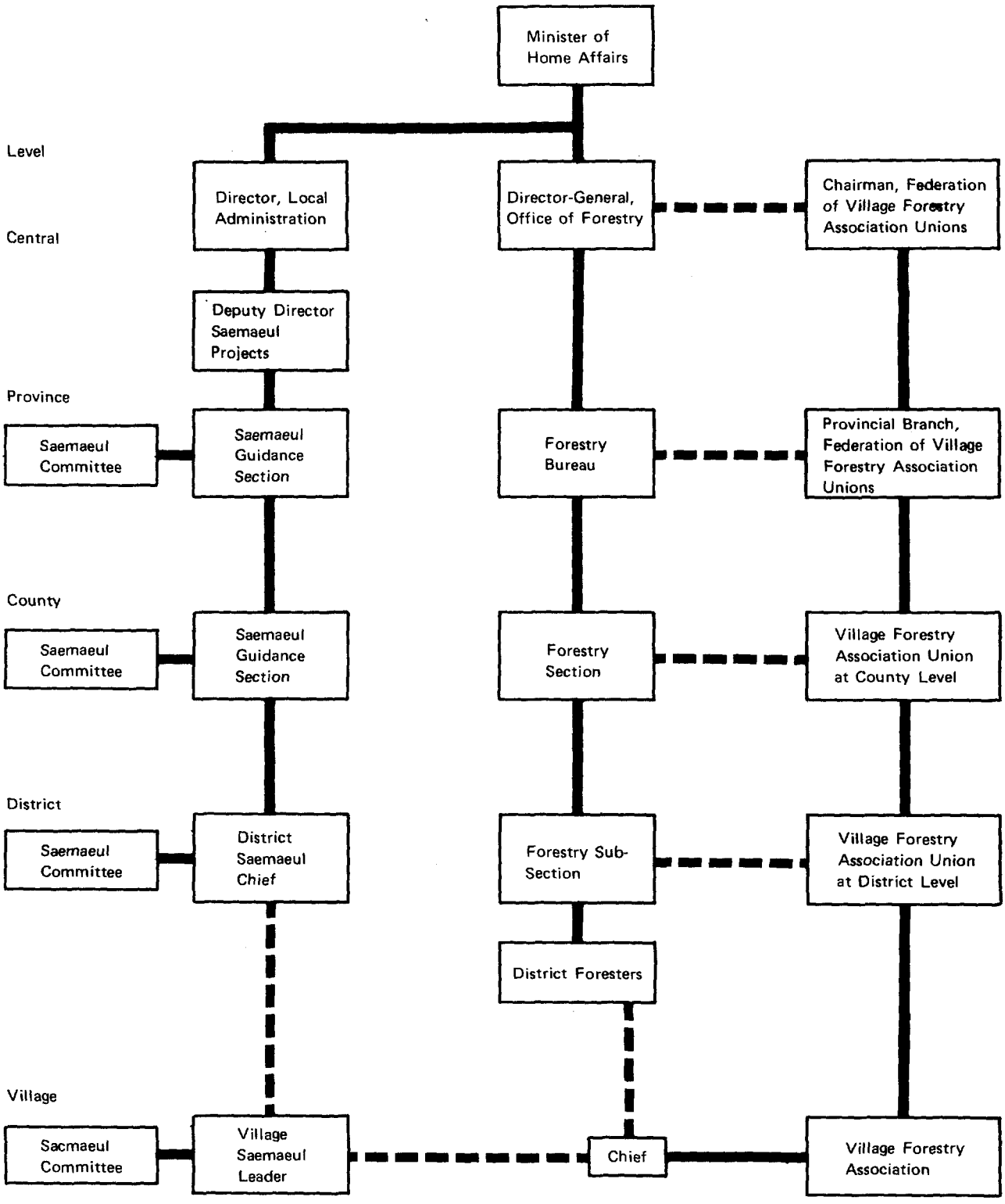
RURAL INFRASTRUCTURE PROJECT

Fuelwood Component: Species Distribution

Species	% of Area
"Forest" Areas - fuelwood species	
Robinia pseudoacacia	22
Alnus firmus Alnus hirsuta	18
- dual-purpose species	
Pinus rigida	29
Pinus thunbergii	2
"Non-Forest" Areas - fuelwood species	
Lespedeza sp Amorpha sp	29
	100

Note: The above distribution is based on preliminary surveys only and has been used for cost estimating purposes only. A more detailed breakdown will be available after final designs are completed and this may include additional minor species.

KOREA
RURAL INFRASTRUCTURE PROJECT
Organization Chart:[1/] Fuelwood



[1/] Principal project units only shown.

KOREA

RURAL INFRASTRUCTURE PROJECT

Roads and Bridges Component

The Transport Sector

1. Transport needs in Korea are served by all modes, which comprise a good railway system (3,100 km), a rather dense highway network (44,200 km), and important coastal shipping lanes. Priority was given to developing the railways until 1967, when the Government began to place emphasis also on highways and ports. In the Second Five-Year Plan (1967-71), capital investments in highways were about 50% higher than that of railways and, in the Third Plan (1972-76), highway expenditures are expected to be more than double those for railways. During the last decade, highway investments included the construction of about 400 km of four-lane expressways and the reconstruction and improvement (including paving) of over 1,500 km of the national highway network, out of a total of 8,660 km. The Provincial and county road networks were also improved and received about 40% of the total invested on highways, although they carry less than 40% of the total traffic in the country. Village roads received less attention from the Government until 1971, when it began to launch the Saemaeul Movement (para 6), in which it assists and organizes the farmers for building and improving those roads.

2. The Provincial and county road networks are generally adequate in density to satisfy traffic demands but many roads are badly constructed, poorly maintained and in a state of disrepair. Together with the need to improve the Provincial and county roads, the construction of local roads giving access to the villages, where about 45% of the population live, is of high priority, as shown in Annex 20. Unfortunately the data base is not yet refined enough to make a precise ranking of priorities between the various levels of the road system. Progress in strengthening the national transportation system has been assisted by the Bank Group with several loans, credits and a grant, totalling US$401.7 million. This assistance comprised five Railway Projects (Credits 25-KO and 110-KO, Loan 669-KO/Credit 183-KO and Loans 863-KO and 1101-KO), two investment studies (a grant, and Credit S4-KO), two Highway Projects (Loans 769-KO and 956-KO) and a Port Project (Loan 917-KO). A Third Highway Project was recently approved by the Executive Directors. The present project would be the first Bank Group operation to finance village roads in Korea.

Background

3. In 1969, an inventory of Korea's village roads was made and it was found that about 12,500 km of such roads existed, having been built entirely by the villagers themselves, without government support. At the same time

it was estimated that a total of about 46,000 km of village roads would be needed to give adequate access to all Korea's villages. Progress since 1970 has been impressive with about 7,000 km being constructed in each of several years (Table 1). It is estimated that, by the end of 1975, the roads remaining from the original target will total about 4,700 km and out of these, 850 km have been scheduled for construction in 1976 and 1977, under the project.

4. The achievements listed in Table 1 should be treated with a degree of caution. It is probable that some of the road lengths included under new construction were badly-maintained existing roads that were reconstructed (para 21). Therefore, a new survey was undertaken to determine the remaining high priority needs in this sector, taking into account population shifts and agricultural development since 1969. The accomplishments listed in Table 1 for 1974 are much below the levels in earlier years because of the general shortage of fuel, materials, and supplies following the sudden increase in oil prices in late-1973.

5. A survey to determine the needs for bridges on rural roads was made in 1972 and 1,781 sites were identified. In addition, it was recognized that additional bridges would be needed on roads to be constructed after 1972. Over 700 of the smallest bridges (less than 10 m in length) were constructed in 1974 and the 1975 target comprises 527 bridges between 10 m and 20 m in length (Table 1). The 200 bridges to be constructed in 1976-7 under the project would generally be longer than 20 m.

6. Since 1971, construction of village roads and bridges has fallen under the Saemaeul Movement, whereby the Government supplies materials, skilled labor and construction supervision, while unskilled labor is provided by the villagers themselves (paras 7 and 16). Roads and bridges fall under the second category of Saemaeul projects directed at "self-help" villages (Annex 2).

7. Village roads generally follow the natural topography, so as to minimize earthworks. In flat country, the road usually follows a property boundary, to avoid right of way problems, and is raised above the annual flood level. In most cases, new roads also follow existing footpaths or tracks. Construction is highly labor-intensive, with shovels used for excavation, hand carts for hauling and with little attention given to compaction. Where available, river gravel or broken stone is used for surfacing, giving a rough and uneven (though durable) surface. Elsewhere, unselected soil is used for surfacing and this may not always be traffickable in the wet season.

8. Bridges are normally of a simple reinforced concrete slab (or beam and slab) construction, with solid piers and abutments. Standard spans (3 to 5 m) are multiplied to give the required waterway area. Calculations of waterway area are based on few data and outmoded design methods. River beds generally consist of deep coarse alluvium and scour beneath the simple spread footings used is a source of failure of some bridges. The design of foundations does not take into account local conditions and there is inadequate supervision of the quality of concrete used for this work. The quality of the concrete used in the superstructure is also often inadequate, due to

poorly graded aggregates (obtained from the river), segregation during mixing, excessive water use and, in some cases, skimping on the use of cement. The result is a weak, porous concrete, subject to failure by freezing/thawing and corrosion of the reinforcing steel. The average life of such bridges would be no more than five to ten years. Measures to correct these deficiencies in concrete construction would be incorporated in the project (paras 10, 16 and 20).

The Roads and Bridges Component

9. The roads and bridges component of the project comprises approximately 850 km of roads (about 440 sub-projects) and about 200 bridges. Most of the roads would serve to link isolated villages to the county road network or, in a few cases, to complete links in that network. Preliminary sub-project identification and selection has been completed for the 1976 work program and a final list of sub-projects, taking into account the Bank's comments on the preliminary list, will be available by the end of February, 1976. Selection of the 1977 program will be completed before October, 1976. A breakdown of the proposed program by Provinces is shown in Table 2. The roads would be constructed over two years (1976 and 1977). The Government proposes to complete the whole bridge program in 1976 but, as some of the bridges are up to 50 m in length, this may not be feasible, particularly since the working season for Saemaeul projects is limited to a few months per year (para 19). Allowance has therefore been made for the bridges program under the project to overlap into 1977.

10. The roads would be constructed to about 5.0 m width, with geometric standards such as to minimize construction costs. Present standards regarding drainage and bank protection are satisfactory and would be continued. However, better supervision (para 20) would ensure a higher standard of compaction and better surfacing. Village roads would have a graded surface of crushed stone or river gravel. Bridges would be designed for single-lane traffic only and would normally have a 4.0 m travelled width. The design loading would be the Korean equivalent to the HS-20-44 loading of the American Society of State Highway Officials.

11. The cost of road construction is estimated to be about US$5,400/km, based on detailed engineering of sample road sections representative of all terrain conditions. The cost of bridge construction is estimated to be about US$10,000 for a bridge 30 m long, based on a satisfactory standard design. The total cost of the roads and bridges program is estimated to be about US$6.8 million (Annex 10, Table 5).

Sub-Project Selection

12. Roads and bridges sub-projects are proposed by the Village Saemaeul Committees, vetted successively by the county and Provincial governments and then sent up to the Central Government for approval (Annex 2). The unfortunate feature of this procedure is that the Planning Divisions in the Provincial Governments, the MOC and the EPB do not participate, beyond the issuance of general guidelines. The roads and bridges program is coordinated

with other Saemaeul activities by the Saemaeul Planning Division in the MHA (Figure 1).

13. Varying criteria are applied to the selection of roads. Priority seems to be given to villages that are self sufficient and active in helping themselves, those requiring extensions to existing roads and those whose past performance has been good. Until recently, there has been no use of quantitative sub-project selection criteria.

14. MHA has now introduced the following set of selection criteria for roads: road length; construction cost; population served; farmland served; and estimated traffic volume. A procedure for relating these factors to the economic rate of return is described in Annex 20, which also gives limiting combinations of road length and farmland served for economic viability. A simpler version of this procedure has been used to select the road sub-projects included in the present project. Moreover, some of the sub-projects included in the 1976 program do not strictly meet the above quantitative selection criteria but have been included because of unusual local conditions of heavy local support, which indicate a high priority.

15. The data base for sub-project selection is barely adequate, as few measurements of benefits (or even of traffic volumes) have been made at this level of the road system. This topic would therefore be of high priority for inclusion in the proposed program of evaluation studies included in the project (para 5.17).

Construction Methods

16. For road construction, the present labor-intensive methods (para 7) would continue. For bridges and minor structures, hand-mixing of concrete would be discontinued and replaced by the use of simple concrete mixers, powered by hand or by small gasoline engines. These mixers would not displace a great amount of labor but would make possible concrete of adequate strength and durability (para 8). One mixer per bridge, or a total of 200, would be procured under the project. When not needed for bridge construction, this equipment would be used for water supply sub-projects (Annex 7) or other Saemaeul activities. The ungraded stone or gravel presently used for surfacing is not entirely satisfactory and therefore provision has been made in the project for the procurement of nine small stone crushers. These crushers would also be used to produce concrete aggregates. One crusher per Province would be procured, so as to test their applicability to Korean conditions.

Execution

17. The roads and bridges program would be implemented by the Ministry of Home Affairs (MHA), through its Local Administration Bureau. MHA would supply basic materials such as cement, reinforcing steel and aggregates. Actual construction would be carried out by the villagers themselves without any payment in cash or kind. The works would be maintained by the Village Saemaeul Committee also at no cost (para 21).

18. Saemaeul Guidance Divisions have been established in the MHA and the Provincial and county governments to approve programs, supply materials

for and monitor the execution of Saemaeul road projects. The county governments, in addition, provide some technical assistance to survey new road alignments. The deficiency in this organization at present is that the Ministry of Construction (MOC) and the Construction Bureaus in the Provincial and county governments, which are responsible for the construction of major roads and have the necessary expertise and laboratory and survey facilities to assist the rural roads program, are not involved. Only one engineer is available in each county to help with the planning and execution of Saemaeul projects (including electrification, water supply, and irrigation, as well as roads and bridges). He lacks the time and facilities to supervise adequately the roads and bridges program.

19. The works are executed under a contract with the Village Saemaeul Committee, which also prepares work plans and programs. The Village Saemaeul Leader (Annex 2) is in charge of the works, which are usually carried out from February to May and from September to November. Work is often interrupted by the exigencies of the crop calendar. Skilled laborers are hired by the village or provided by the county administration for some activities in bridge-building, such as carpentry and steel bending.

20. To improve the effectiveness of supervision and the quality of workmanship, the Government has agreed to the following changes in project management:

(a) The Provincial Construction Bureau would be responsible for the planning and execution of bridgeworks;

(b) The County Construction Division would be responsible for the planning and execution of the roadworks; and

(c) The construction work schedules would be prepared by the Provincial Construction Bureau for bridges and the County Construction Division for roads, in agreement with the Village Saemaeul Committee.

In each case, lower-level officials would be used for day-to-day activities, as at present. However, ultimate responsibility would be at the levels indicated, in order to ensure that adequate standards are maintained.

Maintenance

21. Maintenance of the facilities constructed under the project would be the responsibility of the Village Saemaeul Committees. As maintenance normally involves only labor and local materials, cash outlays would rarely be required. Road maintenance is not satisfactory at present but this is due to a lack of supervision by and advice from the responsible district and county officials. Supervision would be strengthened under the project by involving engineers from the County Construction Division, who would inspect the village roads periodically, point out maintenance deficiencies to the village leaders and advise on any unusual problems. Villages with a poor

record of maintenance would be given low priority in future development projects. Adequate maintenance would require an average of 180 man-days/km/yr.

Environmental Effects

22. The roads and bridges components of the project would have only minor effects on the physical and human environment. During construction there would be a temporary increase in erosion and sedimentation in some areas but the methods to be employed for bank protection should minimize this. The roads and bridges program would provide many villages with vehicular access for the first time and would thus greatly improve the villagers' access to health and other social services.

ANNEX 6
Table 1

KOREA

RURAL INFRASTRUCTURE PROJECT

Construction Progress: Rural Roads and Bridges

Year	Achievements	
	Roads (km)	Bridges (No.)
Up to 1969	12,507	-
1970	7,167	-
1971	7,526	-
1972	7,351	-
1973	5,367	-
1974	Repairs only	761
1975	1,540	527

Source: Ministry of Home Affairs.

KOREA

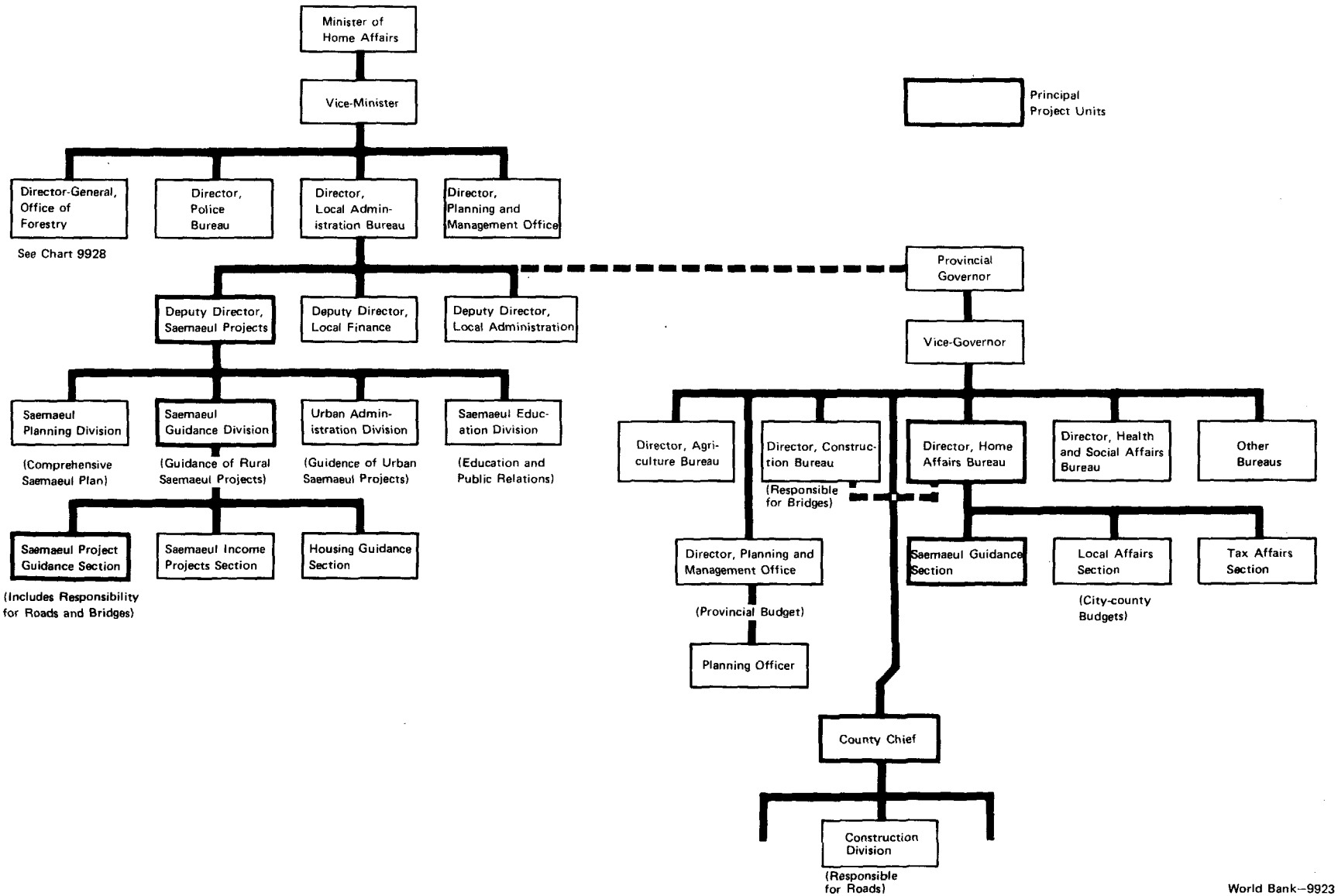
RURAL INFRASTRUCTURE PROJECT

Provincial Distribution of the Roads and Bridges Component[1/]

Province	Roads		Bridges
	No.	Length (km)	(No.)
Gyeong-gi	49	105	15
Gang-weon	29	88	17
Chungcheong Bug	34	60	34
Chungcheong Nam	33	127	22
Jeonra Bug	51	76	30
Jeonra Nam	81	128	21
Gyeongsang Bug	61	142	22
Gyeongsang Nam	94	112	35
Jeju	7	12	4
Total	439	850	200

1/ This is an approximate distribution based on the 1976 program. Final figures will be available only after the 1977 program has been selected.

KOREA
RURAL INFRASTRUCTURE PROJECT
Organization Chart: Roads and Bridges Component



World Bank—9923

ANNEX 6
Figure 1

KOREA

RURAL INFRASTRUCTURE PROJECT

Water Supply Component

The Water Supply Sector

1. As in most countries, a greater effort has been made in Korea to supply urban populations with potable water as compared with rural centers. The larger cities have generally adequate water supply systems. The Third Five-Year Plan (1972-76) includes a program to serve about 8,000 villages out of a national total of about 35,000. However, by the end of the fourth year of the Plan in December 1975, only about half the target had been met, owing to budgetary constraints. Even with the project, these constraints would remain and the planned rate of progress for 1976 and 1977 is about 1,000 villages per year.

2. The extent of water supply service in various sized communities is shown in Table 1. It will be noted that the rural centers with populations between 1,000 and 20,000 have a much lower percentage of population served (3%) than the smaller rural villages (26%). This is because the simple and inexpensive systems used in villages cannot be used for these larger centers and also because the program of the Ministry of Health and Social Affairs (MHSA) is limited to villages, while the Ministry of Construction (MOC) has given priority to the larger cities. The Government's targets for 1981 are to increase the proportion of the urban population served from about 67% to 81% and, in the rural sector, to provide piped systems in about one-half of the 35,000 villages and to 35% of the rural centers. These targets appear to be attainable, given adequate budgetary support.

3. Korea is not a water short country, the rainfall averaging about 1,000 mm in the north and about 1,400 mm in the south (Annex 1). The country is mountainous with many narrow valleys containing alluvial deposits. It is not difficult to get small quantities of groundwater and in all villages (and even larger cities) there are many dug or driven wells, the latter having suction hand pumps. These wells commonly belong to individual households, although communal wells are also used, particularly for laundry purposes. A detailed description of the status of water supply and sewerage in Korea may be found in the "Water Supply and Sanitation Sector Study", 1975, prepared by the WHO/IBRD Cooperative Program.

The Saemaeul Movement in Water Supply

4. Village water supplies fall under the second category of Saemaeul projects (Annex 2) and are directed at "self help" villages, which are able

to provide all the necessary unskilled labor and, occasionally, a small cash contribution. Materials, skilled labor and supervision are provided by the Government, through the county administrations (para 15). The number of systems constructed in recent years has averaged about 900 per year (Table 1) and these now serve about 13% of all villages. As the proportion of population served is twice this figure, one may assume that the program to date has concentrated on the larger villages.

5. The simple piped water systems are either gravity supplies from a spring or are pumped from a nearby well. The wells or springs are protected and the system is normally provided with a concrete storage reservoir on adjacent high ground or else a hydro-pneumatic tank is used to provide pressure. Small diameter polyvinylchloride (PVC) pipes are used for the distribution system, which serves individual houses. Concrete is mixed by hand, which leads to unsatisfactory quality in some cases (para 16). However, the overall quality of workmanship is adequate.

6. The program has been assisted by funds from several international agencies. UNICEF provided materials for 219 systems between 1971 and 1974. In 1972, the Cooperative for American Relief Everywhere provided materials for 9 systems. An Asian Development Bank loan supplied US$480,000 for 100 systems in 1975. Apart from the proposed project, and continuing UNICEF funding of training, demonstration projects and technical assistance, no other international funding is in prospect for 1976-77.

The Water Supply Component

7. The project would include about 2,000 water supply systems. The approximate distribution of sub-projects by Provinces is shown in Table 2. The rate of construction would be similar to that reached in recent years, though the systems would be somewhat more complex, as the spring sources are nearly exhausted, and would therefore require more survey and design effort. For the same reason, unit costs of supply are increasing.

Water Supply Organizations

8. At the national level, the project component would be supervised by the Sanitation Facilities Sub-section of the Environmental Sanitation Section of the Environmental Health Bureau, within the Ministry of Health and Social Affairs (MHSA) (Figure 1). As well as having general responsibilities in the field of health, MHSA is also responsible for sanitary inspections, pollution control, vermin control and nightsoil disposal. The Sanitation Facilities Sub-section is responsible for rural water supplies and waste disposal.

9. The Sanitation Facilities Sub-section prepares standard designs and specifications and helps prepare training materials for the engineers and sanitation personnel at the Province and county levels and also for the village leaders. Training courses are given by the National Institute of Health, also under MHSA. National Ministries generally have bureaus in

each Province, under the administrative control of the Provincial Governor. Each Provincial Bureau of the MHSA has either a Public Health Section or a Sanitation Section, with an engineer who reviews and approves all plans for village water supplies prepared by the county sanitarians. The Province sanitary engineer is assisted by three or four sanitarians and two or three technical assistants, trained by the National Institute of Health. Each county has a health center with three to four sanitarians. The average county has about 250,000 people and is divided into about ten districts (myons). Each district, which contains about 25 villages, has two social affairs personnel but they have had no special training in water supply. The total number of technical staff dealing with rural water supply is about 550, which would be adequate for the proposed program.

Sub-Project Selection

10. Projects are proposed by the Village Saemaeul Committees and reviewed by the district and county committes (Annex 2). Before final approval is given, the county Saemaeul Committee visits the village to see if it is capable of constructing the proposed water supply. Meanwhile, the national budget process (Annex 14) has detemined the amount of money that can be expended in a given year for village water supplies. The cost of an average supply is about Won 1.8 million or US$3,800 (or about US$50 per household), excluding the imputed cost of volunteer labor (Annex 10, Table 6). The funds available are distributed to each Province on the basis of population. The Province then allocates funds to each county, also on the basis of population. The county office decides how many water supply projects can be financed and reviews the list of projects proposed by the villages. The final selection of the water supply program is made by the sanitarians of the county health center, using the following criteria:

(a) The institutional capacity of the village, as demonstrated by its past record in Saemaeul activities and its willingness to undertake the sub-project;

(b) The size of the village (which must be greater than 20 households);

(c) The incidence of waterborne diseases, particularly of typhoid;

(d) The state of the village's existing water services; and

(e) The cost of a simple piped system (which depends largely on the available source, spring sources being preferred).

These criteria are satisfactory and would continue to be used under the project. A preliminary list of sub-projects, selected according to these criteria, has been drawn up and is being revised in accordance with the Bank's comments. The list of about 1,000 sub-projects for the 1976 work program will be finalized by the end of February, 1976 and the 1977 work program will be submitted to the Bank before October, 1976.

11. After the villages to be supplied have been selected, the sanitarians inspect all available water sources, check the reliability of the yield and collect samples for chemical and bacteriological tests. The final selection of a source is based on this information and a preliminary cost estimate. After the source has been decided upon, the county engineering office under the Ministry of Construction (the Construction Division) is notified to proceed with the preparation of detail designs, bills of materials and other engineering documents, including a work schedule. The county Construction Division has four or five civil engineers and one is responsible for water supplies, with several technicians to assist him. A team visits the village to prepare a map to scale, measure the differences in elevation between the source and the village, lay out the distribution system and locate the storage reservoir. This data is taken to the office where the design is finalized and a detailed report and cost estimate is prepared for each village. This report is then reviewed and approved by the Provincial sanitary engineer. The village is given the final design report and construction is scheduled with the help of the county sanitarians. The work is usually done from September until the end of December and must be coordinated with agricultural activities and other village projects. Some villages have completed water systems in two to four weeks but other have taken up to four months.

12. It is estimated that the county engineering office will take about 18 weeks to prepare the water supply reports for each year's program for the county. Under the project, each Province would set up a one-day training session for its county water supply engineers and sanitarians to emphasize the importance of selection of the best and lowest cost source, refinements of design to eliminate contamination, and the importance of making dense concrete that will not leak (para 16).

13. Village water system layouts generally follow standard patterns from an MHSA design manual. The manual includes spring and well protection; design of storage reservoirs, with sizing based on population served; required pipe sizes, based on volumes of flow, frictional resistance and head; methods of joining pipes and specials; and installation and operation of a solution feed chlorinator. The standard plans for concrete works include placement of reinforcing steel and sanitary design of manholes, vents, overflow pipes and similar details. The distribution networks are straightforward in design and provide for a 13 mm unmetered house connection to each dwelling. Normally a single faucet in the courtyard is supplied, which is an appropriate standard of service for existing rural income levels in Korea. A per capita consumption of 80 l/day is allowed for in design and the systems are designed for continuous pressure. The standard design methods used are adequate for the simple systems to be constructed.

14. The project cost estimate (Annex 10, Table 6) is based on detailed designs for a sample of sub-projects and on standardized estimating methods, derived from past experience with similar work, which take into account variations in the number of houses served, type of water source, and length of

pipe required. A final cost estimate would be prepared when all systems have been designed (early in 1976).

Sub-Project Execution

15. Construction of the sub-projects would be done by organized volunteers from the village, instructed and supervised by the sanitarians and technical assistants from the county offices. Since all the sub-projects would be under construction during the same four-month period in the Fall, the amount of supervision available to each sub-project would be quite limited. However, inspection of past projects shows satisfactory workmanship and maintenance. There are a number of skilled and semi-skilled workers in each village, as a result of the fact that all men undergo military training and during this time they also must learn a civilian trade. The villagers are trained in the proper jointing of PVC pipe, the mixing and placing of concrete, the construction of formwork and the positioning of reinforcing steel. When pumps are installed, the village usually hires an electrician and a plumber at their own cost to do the installation.

16. As all concrete is mixed by hand at present, its quality is only marginally adequate. Aggregates are badly graded, the concrete is usually inhomogeneous and excessive water is used. This could result in leaking storage tanks. Satisfactory concrete could be produced using small manual or gasoline engine powered mixers and these would be provided to the county offices under the project. Although intended mainly for the bridge program (Annex 6), the 200 mixers would also be used for the water supply program and other Saemaeul activities.

Operation and Maintenance

17. As each water supply system is completed, a water supply maintenance committee would be formed in the village to operate and maintain the system. For systems which include pumping or water treatment, a regular monthly contribution would be collected from each villager to cover the costs of electricity, chemicals and so on. For simpler systems, contributions are collected at the time major repairs or replacements are made. In many villages, the amount collected exceeds the operation and maintenance cost. Surplus funds go to the village development fund. The county-sanitariums are responsible for monitoring operational standards and water quality. This system has been in effect for some years and works satisfactorily.

Environmental Effects

18. The water supply component would improve the rural environment in Korea, as more water would be available to each household from one or more convenient outlets in the house or courtyard. Water would no longer be obtained by the tedious method of a bucket and a rope or a hand pump, so more water would probably be used for washing. In villages with poor quality

water sources at present (such as streams and open wells), the project would improve the level of public health. It is not anticipated that water flush toilets or other water using appliances would be installed in the foreseeable future. The amount of waste water from food preparation and washing would probably be greater than before. Villages with water systems dispose of waste water through surface drainage ditches that usually drain to rice paddies or other planted areas. The water extraction from aquifers would not be enough to change ground water levels. Thus, no deleterious environmental effects are anticipated.

KOREA

RURAL INFRASTRUCTURE PROJECT

Population Distribution and Status of Water Supply Service

	Category of Community		Number of Communities	Total Population (million)	Number Served by House Connection (million)	% Served	Number not yet served (million)
I.	Cities	above 300,000	6	12.1	10.1	84	2.0
II.	Cities	50,000 to 300,000	29	3.7	2.4	65	1.3
III.	Towns	20,000 to 50,000	160	4.5	1.2	26	3.3
IV.	Rural Centers	1,000 to 20,000	1,339	5.8	0.2	3	5.6
V.	Villages	less than 1,000	35,000	7.6	2.0	26	5.6
	Total		..	33.7	15.9	47	17.8

Progress in Village Water Supply

Year	Number of Simple Piped Water Supplies Constructed
before 1972	589
1972	1,402
1973	949
1974	725
1975 (target)	900
Total	4,565

KOREA

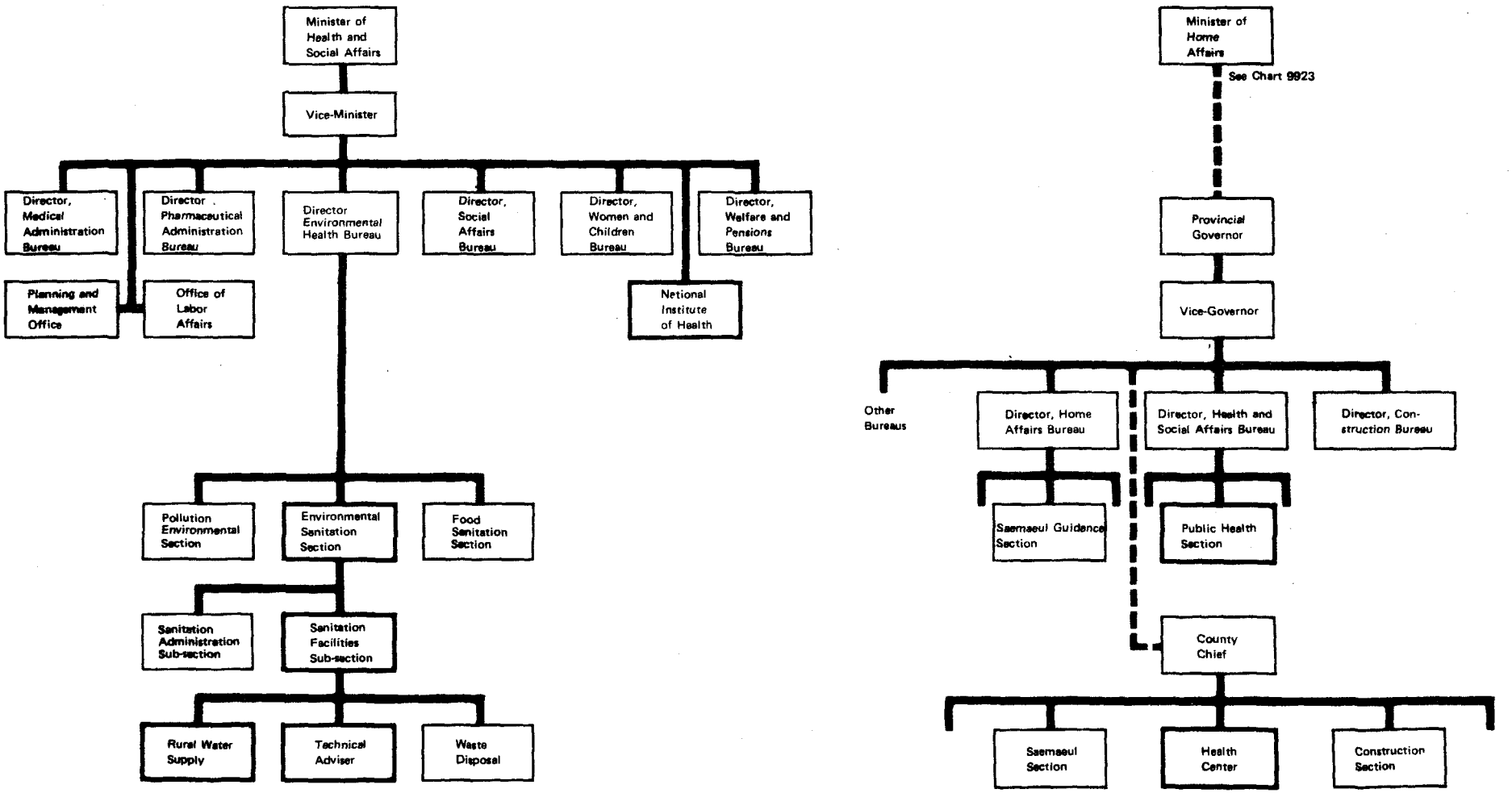
RURAL INFRASTRUCTURE PROJECT

Provincial Distribution of the Water Supply Component 1/

Province	Number of Sub-Projects	Number of Houses Served	Population Served
Gyeong-gi	258	18,900	104,000
Gang-weon	218	15,400	86,000
Chungcheong Bug	146	10,600	63,000
Chungcheong Nam	218	16,200	96,000
Jeonra Bug	198	11,800	73,000
Jeonra Nam	318	21,800	127,000
Gyeongsang Bug	346	27,000	157,000
Gyeongsang Nam	278	33,700	180,000
Jeju	20	400	2,000
Total	2,000	155,800	888,000

1/ This is an approximate distribution based on the 1976 program. Final figures will be available only after the 1977 program has been selected.

KOREA
RURAL INFRASTRUCTURE PROJECT
Organization Chart: Water Supply Component



Principal Project Units

World Bank–9927

ANNEX 7
Figure 1

KOREA

RURAL INFRASTRUCTURE PROJECT

Rural Electrification Component

Sector Background

1. Electricity consumption in Korea has been growing at more than 20% per annum over the last decade and reached 14,000 GWh in 1974 (excluding a small amount generated by self-producers). This is equivalent to a per capita use of 425 kWh. By the end of 1975, about 73% of households will have an electricity supply, 93% of urban dwellers and 59% in rural areas. Close to 80% of the total consumption was accounted for by industry and the remaining 20% by residential and commercial users. The rapid growth of the Korean economy is expected to continue, though at a somewhat slower rate than in the past, and the corresponding electricity consumption growth rate is expected to be about 14-15% per annum through the early-1980's.

2. The Korea Electric Company (KECO) is a public corporation (with stock exchange listing) in which the Government holds a 50% interest. KECO is the sole distributor of electric power in Korea and presently owns and operates about 90% of the country's total generating capacity. KECO also purchases power from a 200 MW hydro-project, operated by the Ministry of Construction (MOC), and the Kyongin Energy Company, a private generating company with a 325 MW thermal power plant. Except for hydro-projects, which are under MOC's jurisdiction, KECO is presently responsible for the planning and construction of all power projects, from nuclear power plants to rural electrification. The Ministry of Commerce and industry (MCI) supervises KECO's activities. MCI decides the basic policy for power development, sanctions all power projects, approves KECO's budget and advises the Government on electricity tariffs.

3. KECO is, in most respects, a strong organisation, which is operating efficiently a rapidly expanding power system. At the end of 1974, KECO had an installed generating capacity of 4,500 MW, as well as 6,800 km of transmission and 55,000 km of distribution line facilities. During the past decade, KECO's thermal efficiency of generation improved from 24% to 33% and system losses declined from 20% to 11%. KECO's organization chart is shown in Figure 1. Its 11,600 employees are well trained, capable and highly motivated. Although KECO makes use of consultants' services for large projects (such as nuclear plants or extra-high-voltage transmission lines), it is fully capable of designing conventional projects and supervising construction works.

4. KECO's financial situation has gradually deteriorated over the past several years, particularly since 1971. A critical stage was reached in 1973,

with a rate of return on operating assets of about 6% and a debt service coverage of only 0.7, leaving no internal contribution to investment. The main reasons for this unfavorable trend have been: (i) a temporary over-investment in generating facilities; (ii) tariff adjustments which were insufficient to offset rising costs; and, as a consequence, (iii) excessive short-term borrowing at high interest rates. In order to recover financially, use should be made (to the greatest extent possible) of long-term funds with a built-in concessionary element, the Government should continue its practice of subsidizing local loans, and KECO should pursue a prudent, cost-oriented tariff policy. A tariff increase of 42% in December, 1974 and a further increase in December, 1975 were steps in the right direction.

Rural Electrification

5. Rural Electrification in Korea started in the early 1960's and, accelerated by the Rural Electrification Law of December, 1965, it has now reached an advanced stage. About 60% of rural households in the country are now electrified. The Law specifies that funds required for village electrification be provided by a combination of government loans, KECO's own investment and consumer contributions. Government loans financed 81% of the total investment in the past (compared to 90% proposed under the project). Loans are made to consumers through the Korea Development Bank (KDB). Terms and conditions are discussed in Annex 14. KECO is responsible for collecting loan repayments from the consumers, together with the electricity bills. The average amount of monthly repayment is about Won 250 per consumer, compared to the monthly electricity bill of about Won 750. The Government loans are said to be guaranteed by the county chiefs, but this does not require the local government to make payments for delinquent rural customers - the county chief is committed only to use his influence and pressure to obtain payment from the customer.

6. Consumer reaction to electrification is very strong. Once electricity is brought into a village, most households are rapidly connected. The average annual consumption of electricity per domestic consumer is about 250 kWh in rural areas, compared to a national average of 620 kWh, but the rural rate of growth is quite encouraging. Most of the rural customers are domestic consumers, being served by single-phase, low voltage systems. Electricity is used mainly for lighting, home appliances and some productive uses, such as crop processing, chicken hatcheries, water pumps and small greenhouses. A few large customers use power for agro-industries and are supplied by three-phase connections at higher voltages. These customers, numbering only about 0.3% of total rural consumers, contribute about 15-20% of the total power demand in rural areas. All consumers are metered, with readings and collections made monthly. The national standard tariff schedules are applied: there is no cross-subsidy to rural consumers.

7. As of the beginning of 1975, some 1,493,000 households in rural areas were electrified and another 150,000 will be completed in 1975. The Government plans to electrify 890,000 households during 1976-78. This will virtually complete the electrification of the country, as the remaining 301,000

households without electricity are in remote mountain areas or on small islands and thus could not be economically connected.

The Rural Electrification Component

8. The proposed project would help finance the government program for 1976, which aims to electrify 305,000 households. The final selection of sub-projects rests with the county government and has already been made. The proposed program would include all Provinces of Korea (Table 1). The 2,700 or so sub-projects would electrify 6,075 villages, with an average of 50 houses per village. The estimated construction cost per household is Won 56,600 (US$117), not including Won 10,000 for house wiring (para 11). This unit cost is about 40% higher than the actual cost in 1974. This is mainly due to the rising costs of materials but also to the fact that most of easy-to-connect villages have already been electrified and future sub-projects will include smaller and less-accessible villages.

9. A typical village would be supplied by extending, from an existing 22.9 kV or 6.6 kV primary feeder, a 4-wire three-phase or a 2-wire single-phase branch on concrete poles to a pole-mounted 10 kVA transformer. The secondary system within the village would be 220 V, single-phase 3-wire. Voltage regulation would be $\pm$ 10% maximum. Aluminum Conductor (Steel Reinforced) (ACSR) is the most commonly used conductor for primary circuits, which provide a capacity of not less than 4 MW. The design standards follow generally accepted standards for rural electrification and should result in a least-cost solution.

Sub-Project Selection

10. KECO would be responsible for the design, construction and operation of the component. The criteria for selection of individual sub-projects include: (a) the proximity of the village (or group of villages) to KECO's existing transmission system; and (b) the density of population. Even though village selection is not strictly based on economic development priorities, it must be remembered that most of the remaining unelectrified villages in Korea will be connected in about three years. Therefore, economic criteria do not appear to be too significant and the decisions as to which villages should be done first should probably be made on purely practical grounds.

Sub-Project Implementation

11. The areas to be electrified having been selected by the county government, KECO then makes the necessary surveys and prepares the designs. The final decision to proceed is then made by the county. Procurement documents for equipment and material would be prepared by KECO, the tendering would be carried out by OSROK, and the erection of poles and stringing of lines would be done by small contractors under KECO's supervision, using relatively labor intensive methods. Since almost all materials and equipment will be furnished by KECO, the contractors are really supplying only labor and erection tools. There are more than 1,000 contractors in Korea capable of handling this work and no problem is anticipated in carrying out the construction

within one year. However, as some procurement delays may develop, it has been assumed that the component would carry over into the first quarter of 1977. The villagers would be required to make a labor contribution to the works within the village, amounting to about 50 man-days per sub-project. In-house wiring would be the responsibility of each consumer. The actual work is normally done by registered contractor and KECO inspects the work before energizing to ensure safety.

12. KECO's Rural Electrification Department is responsible for overall planning and coordination of the project (Figure 1). Detailed design and construction supervision will be done by KECO's 17 branch offices. KECO has about 3,000 engineers and technicians engaged in the distribution sector, which includes rural electrification. These staff carried out a rural electrification program for 280,000 households in 1973 and, therefore, they would be sufficient for executing the project component. After completion of the component, the facilities would be operated and maintained as a part of the KECO's integrated system and thus no special organisational provisions are required.

Environmental Effects

13. The rural electrification project would not cause any significant environmental problem and would have no effect on air or water quality. The low voltage used would not require an exclusive right of way for the distribution lines and would therefore not take any land out of production.

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RURAL INFRASTRUCTURE PROJECT

Provincial Distribution of Rural Electrification Component

Province	Electrified Households as at end of 1975	No. of Sub-Projects	No. of Villages	No. of Households	Benefitted Population
Gyeong-gi	230,987	248	377	18,500	110,445
Gang-weon	99,646	169	330	22,261	132,898
Chungcheong Bug	110,680	178	336	22,807	136,158
Chungcheong Nam	169,151	481	606	39,600	236,412
Jeonra Bug	175,382	165	710	28,940	172,772
Jeonra Nam	266,194	348	2,010	73,564	439,177
Gyeongsang Bug	284,301	728	945	57,303	342,099
Gyeongsang Nam	236,484	357	753	41,728	249,116
Jeju	30,229	8	8	297	1,773
Total	1,642,006	2,682	6,075	305,000	1,820,850

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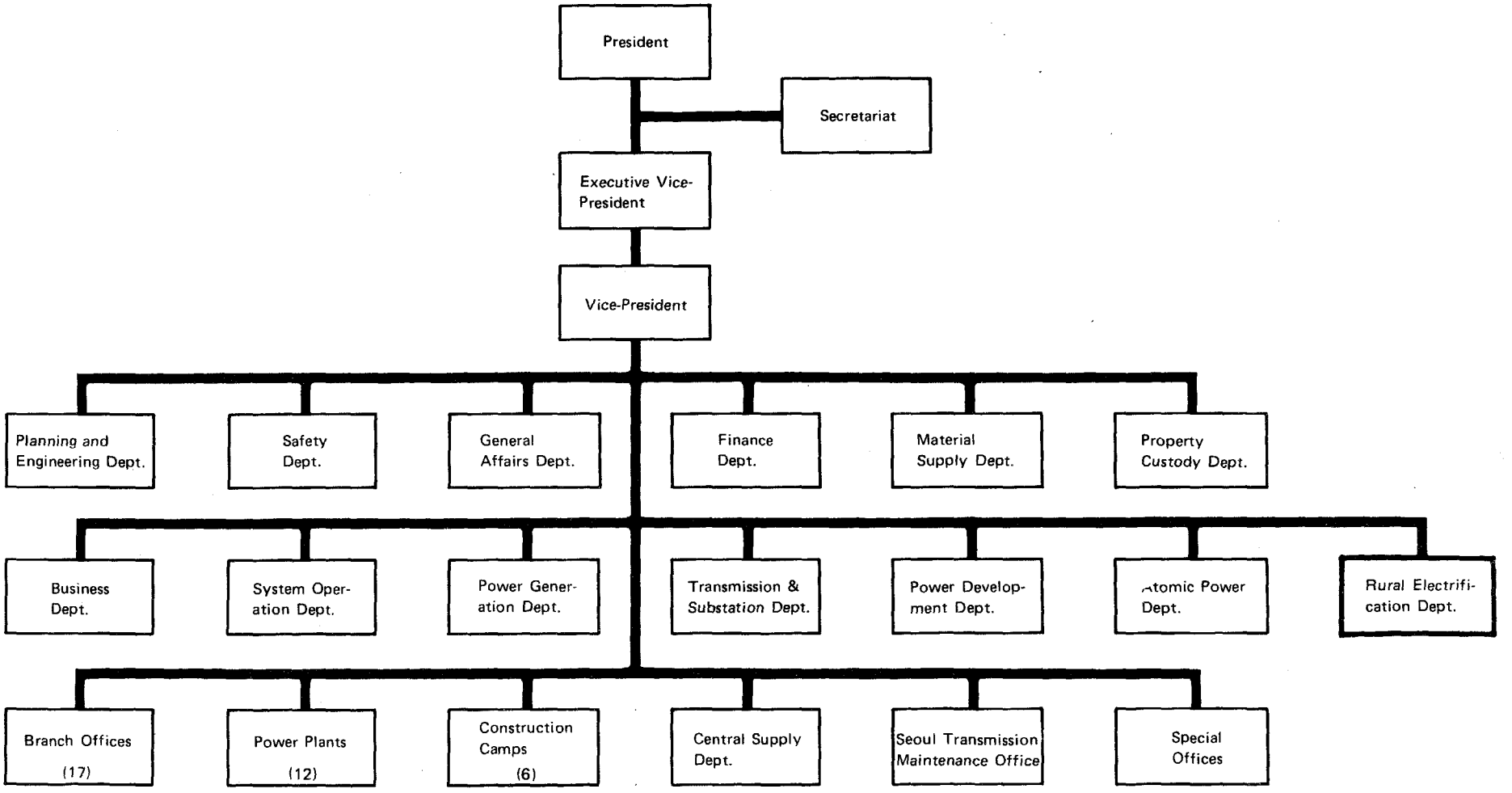
RURAL INFRASTRUCTURE PROJECT
Organization Chart of the Korea Electric Company



World Bank–9929

ANNEX 8
Figure 1

KOREA

RURAL INFRASTRUCTURE PROJECT

Improvements in Hydrologic Services

Present Situation

1. Primary responsibility for hydrologic measurements (rainfall and streamflow) rests with the Ministry of Construction (MOC), through the Water Control Division of the Water Resources Bureau. General climatological data (rainfall, temperature, evaporation, wind velocity and so on) is recorded at a relatively small number of major stations by the Office of Meteorology in the Ministry of Science and Technology. The Office of Meteorology's program is being assisted by the World Meteorological Organization, mainly in staff training. MOC has at present 240 rain gauges, of which 110 are of the recording type, and 181 stream gauging stations, of which 54 are recording stations and the remainder staff gauges read twice daily. ADC also maintains a number of stations in connection with major irrigation projects. Suspended sediment load is recorded by MOC at 22 stations, mainly on major rivers. There are no measurements of bed load.

2. MOC is responsible for publishing rainfall and streamflow records for all its stations on an annual basis. These records are published more quickly than in most countries. However, rainfall intensity data are published only for a few cities and stream gauging records are published in terms of water levels only, even for the 30 to so stations that have rating curves. These records are thus not in a very useful form for potential users. Evidently, empirical formulae are used to derive streamflows when needed. MOC would like to use a digital computer to process rainfall and streamflow records but they lack the necessary equipment (such as a digitizer) and trained personnel. Sedimentation data are not published on a regular basis.

Problems

3. The existing networks appear to be adequate in terms of numbers of stations but nearly all of these are located at population centers, situated generally at low elevations. There is a need for additional rain gauges at higher elevations, for stream gauges on small watersheds and for sediment measuring stations in order to improve surface hydrology and sedimentation analyses in Korea. The gauges in use are of types widely used internationally. However, some gauges, which have been in operation ten to twenty years are nearing the end of their useful lives and many require replacement. There is also a need for additional surveying and flow measuring equipment, so that rating curves can be developed for all streamflow stations.

4. While the needs for additional equipment are of high priority, they are perhaps overshadowed by the need to advance the analytical methods for hydrological aspects of design now used in Korea. Due to the lack of data in past years, reliance had to be placed on empirical formulae and highly simplified methods and these are still in used for the spillway design flood peak. With the data now available, these methods could be replaced with more accurate modern techniques, such as computer simulation for predicting the complete hydrograph. Such techniques would allow streamflow volume to be calculated, as well as assisting in flood studies. A small start was made on this by the UNDP/FAO Upland Development and Watershed Management Project 1/ but this work has not been followed up and has thus had little impact. Indications are that present methods lead to conservative designs and that improvements in hydrologic analysis could lead to cost savings on many projects. Simulation techniques could also be used to analyse sediment problems in estuaries and reservoirs.

Proposed Assistance

5. Under the project, funds would be provided to the MOC to purchase additional equipment and to hire consultants. Equipment (Annex 11) would include new and replacement recording rain and stream gauges, equipment for establishing rating curves and for measuring sediment loads, survey equipment and vehicles (para 7(c)). If recommended by the consultants, a digitizer would be purchased to allow chart records to be converted to digital form.

6. The services of a conulting firm specialized in hydrology (or a consortium of firms, one of which is specialized in hydrology) would be required for a period of two to three years. Outline terms of reference are given below. It is expected that about 35 man-months of expatriate manpower would be required. The cost estimate for these services is given in Annex 10, Table 8. It is envisaged that a full-time project manager would be assisted by short-term specialists in instrumentation, computer simulation, training and so on. However, because of the specialized nature of the required services, it would be appropriate to allow the final scope of the work to be defined only after consultant proposals are received.

Outline Terms of Reference

7. The consultants shall:

(a) Review the existing network of rain gauges, stream gauges and sediment measuring stations operated by various agencies in Korea and recommend appropriate additions, replacements, modifications and changes in operating procedures, with particular reference to mountain areas and small watersheds;

1/ B. Samuelsson, A. Yamamoto and D.P. Carr, "A Computer Study of the Role of Upland Reservoirs in the Management of Water for Rice", Working Paper No. 5A, AGL/ROK 67/522, FAO, Seoul, August 1973.

(b) Assist MOC in accelerating its efforts to obtain rating curves for its stream gauging stations;

(c) Advise on the procurement of equipment needed for (a) and (b);

(d) Review the MOC's proposals to computerize its publication of daily rainfall and runoff records and, if necessary, advise on the procurement of hardware and assist in the production of software for this purpose;

(e) Advise on the appropriate scope and format of published records;

(f) Identify areas in which improved analytical methods are needed by the user water development agencies in Korea, rank these in order of urgency and select some high priority items for intensive study ("analytical studies") 1/;

(g) Carry out the selected analytical studies, making full use of existing Korean data (including that available from several UNDP studies) and modern analytical techniques in hydrology, including (if appropriate) computer simulation;

(h) Following each analytical study, recommend appropriate design methods for Korean conditions and collaborate with the principal user agencies (MOC and ADC) in producing design handbooks, in the Korean language, to replace those now in use;

(i) Prepare, about six months after beginning work, a detailed plan of work for the remainder of the assignment and discuss and agree this with MOC and the Bank;

(j) Propose administrative procedures aimed at keeping MOC and the other user agencies fully informed at all times on the progress of the assignment;

(k) Prepare, at the conclusion of the assignment, a technical report (in English) summarizing the work done, identifying future needs for improvement in hydrologic services, and giving the theoretical basis for the handbooks produced under (h), worked examples of their use, and case studies to show the effect of the new methods on project costs, safety and so on for a few selected projects; and

---

1/ Present indications are that these would include reservoir size determination, spillway design and prediction of sedimentation rates, with an emphasis on small watersheds.

(1) Make recommendations on staff training needs (for MOC, ADC and any other user agencies), advise on the selection of personnel and supervise the in-service training of staff, both for hydrologic measurements and for design.

Coordination

8. A Hydrology Steering Committee would be required to coordinate the efforts of the various agencies (MOC, ADC, the Office of Meteorology and so on) involved in hydrologic measurements and design. The committee would probably be chaired by the Director of the Water Resources Bureau in MOC and would include representatives from the above agencies, semi-government research bodies such as the Korea Institute of Science and Technology, the major universities, and possibly some private consulting engineers. The Steering Committee would facilitate coordination between agencies, review the work of the consultants and assist the agencies in the adoption of the findings of the study.

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RURAL INFRASTRUCTURE PROJECT

Cost Estimates : Summary

	Item	Local	Foreign	Total	Local	Foreign	Total	Foreign Exchange
		-----Won billion-----			-----US$ million-----			%
1.	Minor Irrigation	15.1	10.2	25.3	31.3	20.9	52.2	40
2.	Upland Reclamation	2.6	1.7	4.4	5.4	3.6	9.0	40
3.	Fuelwood	6.5	0.3	6.8	13.3	0.7	14.0	5
4.	Roads and Bridges	2.1	1.2	3.3	4.3	2.5	6.8	37
5.	Water Supply	2.2	1.5	3.6	4.5	3.0	7.5	40
6.	Rural Electrification	6.9	10.4	17.3	14.2	21.4	35.6	60
7.	Project monitoring and evaluation	0.15	--	0.15	0.3	--	0.3	5
8.	Training	0.05	0.05	0.1	0.1	0.1	0.2	30
9.	Technical assistance	0.1	0.15	0.25	0.2	0.3	0.5	60
	Sub-total	35.7	25.5	61.2	73.6	52.5	126.1	42
	Price Contingency[1/]	4.8	3.6	8.4	9.9	7.5	17.4	43
Total Project Cost		40.5	29.1	69.6	83.5	60.0	143.5	42

1/ Physical contingencies are not included, due to the program nature of the project. Any rise or fall in quantities or unit prices (other than the effects of inflation) would be compensated by an increase or decrease in the number of sub-projects included in the project. The price contingency is computed in Annex 12, Table 1.

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RURAL INFRASTRUCTURE PROJECT

Cost Estimates : Minor Irrigation

Item	Unit Cost[a] Won '000/ha	Number of Sub-Projects	Area ha '000	Total Cost[a] Won billion
A. Small Dam (typical)				
Land Acquisition	430			
Dam	1,070			
Canals	200			
On-Farm Development	10[b]			
Materials : Cement and steel	150			
Miscellaneous	100			
Survey and Design	40			
Supervision	130			
Sub-Total	2,130	43	9,212	19.6
B. Pumping Stations	1,320	22	4,248	5.6
C. Weir		1	52	0.1
D. Vehicles (for ORD)				--
Total		66	13,512	25.3
				or US$52.2 million[c]

a/ Based on January, 1976 price levels.

b/ Major part of on-farm development cost would be borne directly by the farmers and would be equivalent to about Won 200,000/ha.

c/ The estimated foreign exchange component is 40%.

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RURAL INFRASTRUCTURE PROJECT

Cost Estimates : Upland Reclamation[1/]

Item	Conservation Practice		
	Contour Farming	Semi-bench Terraces	Bench Terraces
	Won'000/ha[2/]		
Preparation and Design	145	145	145
Clearing	80	80	80
Earthworks for Farmland	90	165	220
Access Roads	55	55	55
Farm Roads	40	40	40
Drainage	75	75	75
Miscellaneous Works	45	25	25
Materials : Cement and Steel	20	20	20
Fertility Improvement Work	155	155	155
Fertilizer and Lime	40	40	40
Supervision and Management	120	150	160
Total: Won'000/ha	865	950	1,015
US$/ha	1,780	1,960	2,090
Assumed proportion of project area (%)	20	25	55
Average unit cost (US$/ha)	1,995 (say 2,000)		

Total Cost: Upland Reclamation Component (4,500 ha[2/])
Won 4.4 billion
US$ 9.0 million[3/]

1/ Based on January, 1976 price levels. Further details are given in Reference 1.
2/ Areas are net developed farmland areas.
3/ The estimated foreign exchange component is 40%.

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RURAL INFRASTRUCTURE PROJECT

Cost Estimates: Fuelwood

Average Unit Cost of Fuelwood Blocks[1/]

	"Forest" Land (85,836 ha)	"Non-Forest" Land (41,164 ha)
	(Won '000/ha)	
Financial Costs		
Materials - Seedlings	30.5	35.0
- Fertilizers	3.6	9.0
Transport - Seedlings	1.3	3.2
- Fertilizer	0.1	0.2
Miscellaneous	7.0	8.7
Supervision	3.2	6.3
Total financial cost:	45.7	62.4
Imputed Village Costs (labor)		
Site Preparation	5.3	-
Planting	28.3	70.7
Fertilizing	7.1	17.7
Weeding	8.5	8.5
Sub-total	49.2	969
Total imputed cost:	94.9	159.3

Weighted average financial cost:

Vehicles (Annex 11)	US$500,000		Won 51.2/ha
Research Equipment	US$100,000	or	Won 6.50 billion

Total financial cost: Fuelwood blocks component (127,000 ha)

Won 6.8 billion
US$ 14.0 million[2/]

1/ Based on January, 1976 price levels and on unit prices listed in Table 9.

2/ The estimated foreign exchange component is 5%.

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RURAL INFRASTRUCTURE PROJECT

Cost Estimates : Roads and Bridges

I. Roads: Average unit cost[1/]

Financial Costs	Won '000/km	US$/km
Culverts and minor structures	2,470	5,090
Engineering & construction supervision	180	370
Total financial costs	2,650	5,460
Imputed Village Costs		
Right of Way	610	1,260
Unskilled labor	1,750	3,610
Total imputed cost	5,010	10,330

Total financial cost: Roads program (850 km)
Won 2.25 billion
US$ 4.64 million

II. Bridges: Average unit cost[1/]

Financial Costs	Average 30 m length Won '000	US$
Materials	3,650	7,530
Equipment operation	190	390
Skilled labor	720	1,480
Engineering & construction supervision	310	640
Total financial costs	4,870	10,040
Imputed Village Costs		
Unskilled labor	1,080	2,230
Total imputed cost	5,950	12,270

Total financial cost: Bridges program (200)
Won 0.97 billion
US$ 2.00 million

III. Equipment

	Won million	US$ '000
Stone crusher (9 @ US$15,000)	65	135
Concrete mixers (200 @ US$200 each)	20	40
Sub-total	85	175

Total financial cost: Roads and Bridges Component
Won 3.3 billion
US$ 6.8 million[2/]

1/ Based on January, 1976 price levels and on unit prices listed in Table 9.
2/ The estimated foreign exchange component is 37%.

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RURAL INFRASTRUCTURE PROJECT

Cost Estimates: Water Supply

Cost of a Typical System[1]:

	Won '000
Financial Costs	
Piping, specials, valves	1,037
Electric pumps[2]	54
Cement (250 sacks)	154
Chlorinator	60
Timber	30
Power installation	200
Reinforcing steel	125
Miscellaneous	165
Total financial cost:	1,825
Imputed Village Costs	
Aggregates	65
Unskilled labor	1,135
Sub-total	1,200
Total imputed cost:	3,025

Total financial cost: water supply component (2,000 systems)

Won 3.6 billion
US$ 7.5 million[3]

1/ Based on January, 1976 price levels and on unit prices listed in Table 9.

2/ Assumed to be required in 50% of sub-projects.

3/ The estimated foreign exchange component is 40%.

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RURAL INFRASTRUCTURE PROJECT

Cost Estimates: Rural Electrification[1/]

Financial Cost

Materials	Won million
Poles	3,091
Conductors	2,534
Hardware	272
Insulators	777
Pole Transformers	944
Switches, Fuses	353
Others	4,109
Sub-total:	12,080
Erection	2,589
Overhead	2,589
Total financial cost	17,258
	or US$35.6 million[2/]
Imputed Cost	
Voluntary Labor	111
Total Imputed Cost:	17,369

1/ Based on January, 1976 price levels and on unit prices listed in Annex 11.

2/ The estimated foreign exchange component is 60%.

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RURAL INFRASTRUCTURE PROJECT

Cost Estimates: Improvements in Hydrologic Services and other Technical Assistance

Improvements in Hydrologic Services[1/]

	Local	Foreign	Total	Foreign Exchange
	---Won million---			%
Equipment	10	40	50	80
Consultant Services	40	60	100	60
Computer Services	5	20	25	80
Counterpart Staff	25	-	25	-
Total	80	120	200	60
Other Technical Assistance				
Upland Reclamation Adviser	20	30	50	60
Grand Total	100	150	250	60

1/ This is a preliminary cost estimate which would not be finalized until after consultant proposals had been received.

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RURAL INFRASTRUCTURE PROJECT

Cost Estimates: Unit Prices[1/]

Item	Unit	Unit Price Won
Basic Items		
Cement	ton	22,500
Reinforcing Steel	ton	153,000
Excavation (hand)	m^3	250-500
Compacted fill (hand)	m^3	275
Transport (by truck)	ton-km	125
Bulldozer hire	hour	5,200
Minor Irrigation		
Excavation and fill	m^3	150-300
Ditch (2m wide)	m	420
Upland Reclamation		
Clearing	ha	37,000
Sodding	m^2	230
Grave removal	each	6,600-13,400
Access road	m	340
Concrete pipe culvert (0.5 m ø)	m	2,800
Plowing and harrowing	ha	84,000
Fuelwood		
Seedlings	each	11.6
Fertilizer	kg	77.2
Roads and Bridges		
Formwork	m^2	1,300
Concrete Mixer	each	100,000

1/ All prices at January, 1976 levels.

Water Supply	Unit	Unit Price Won
PVC pipe - 75 mm	m	901
- 65 mm	m	780
- 50 mm	m	632
- 25 mm	m	306
- 13 mm	m	98
Pump and Electric Motor		
- 1 hp	each	78,000
- 2 hp	each	108,000
- 3 hp	each	138,000
Rural Electrification (See Annex 11)		
Labor		
Unskilled	man-day	1,800
Skilled	man-day	3,000
Land		
Paddy	ha	4,070,000
Upland	ha	2,400,000
Forest	ha	510,000

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RURAL INFRASTRUCTURE PROJECT

List of Vehicles, Equipment and Materials[1/]

Item	Quantity	Unit	Unit Price (US$)	Total Cost (US$ million)	Method of Procurement
1. Minor Irrigation Component					
Cement	59,200	ton	46.5	2.75	ICB[2/]
Reinforcing Steel	7,200	ton	315	2.27	ICB
Pumps	.	LS	.	1.88	ICB
Motorcycles	100	each	800	0.08	ICB
Sub-total				6.98	
2. Upland Reclamation Component					
Cement	..	ton	46.5		ICB
Reinforcing Steel	..	ton	315	0.19	ICB
Fertilizer	..	ton	..		LSH[3/]
Lime	..	ton	..	0.38	LSH
Research equipment	.	LS	.	0.05	ICB
Sub-total				0.62	
3. Fuelwood Component					
Seedlings	730 million	each	0.011	8.28	LSH
Fertilizer	4,300	ton	308	1.35	LSH
Research Equipment	.	LS	.	0.10	ICB
Vehicles (Light pick-up)	140	each	3,600	0.50	ICB
Sub-total				10.23	
4. Roads and Bridges Component					
Cement	..	ton	46.5		LSH
Reinforcing Steel	..	ton	315	5.83	LSH
Stone crusher	9	each	15,000	0.14	ICB
Concrete mixer	200	each	200	0.04	ICB
Sub-total				6.01	
5. Water Supply Component[5/]					
Cement	20,000	ton	46.5	0.93	LSH
Reinforcing Steel	2,000	ton	315	0.63	LSH
PVC Pipe - 75 mm	1,000,000	m	1.86	1.86	ICB[6/]
- 50 mm	1,000,000	m	1.30	1.30	ICB[6/]
- 25 mm	1,000,000	m	0.63	0.63	ICB[6/]
- 13 mm	600,000	m	0.20	0.12	ICB[6/]
PVC Fittings	400,000	each	0.42	0.17	ICB[6/]
Valves	4,000	each	19.7	0.08	LCB[4/]
Chlorinator	2,000	each	150	0.30	LCB
Timber	.	LS	.	0.08	LSH
Electric Motor and Pump	1,000	each	300	0.30	ICB[6/]
Sub-total				6.40	

Item	Quantity	Unit	Unit Price (US$)	Total Cost (US$ million)	Method of Procurement
6. Rural Electrification					
Concrete Pole	224,000	each	28.4	6.36	LCB
Cross Arm - angle	12,000	each	10.8	0.13	LCB
- square type	119,000	each	3.6	0.43	LCB
Grounding Rods	146,000	each	4.1	0.60	LCB
Pole Transformers - 6.3 kV	5,600	each	167	0.93	ICB
- 22.9 kV	4,800	each	208	1.01	ICB
Conductors - copper	6.1 million	m	0.20	1.24	ICB
- insulated	24.1 million	m	0.16	3.98	ICB
- aluminum	14.0 million	m	0.17	2.34	ICB
Wires	1.9 million	m	0.18	0.34	LCB
Hardware - clamp	45,900	each	2.4	0.11	LCB
- sleeve	17,300	each	1.1	0.02	LCB
- connector	66,400	each	1.7	0.11	LCB
- others	.	LS	.	0.43	LCB
Insulator - pin	217,000	each	2.9	0.63	ICB
- suspension	63,000	each	10.7	0.68	ICB
- shackle	568,000	each	0.27	0.15	ICB
Switch - oil switch	1,200	each	120	0.14	ICB
- cutout switch	17,000	each	34.4	0.58	ICB
Fuse - fuse link	16,800	each	0.74	0.01	LCB
- low voltage	70,500	each	0.06	0.01	LCB
- catch holder	147,000	each	0.39	0.05	LCB
Concrete Block	375,000	each	2.7	1.02	LCB
Others	.	LS	.	3.51	LCB
Sub-total				24.81	
7. Hydrologic Services Component					
Vehicles	.	each	.		ICB
Gauging equipment	.	LS	.		ICB
Digitizer	.	each	.		ICB
Office equipment	.	LS	.		LSH
Miscellaneous Supplies	.	LS	.		LSH
Sub-total				0.05	
Grand Total:				55.10	

Method of Procurement	US $ Million
International Competitive Bidding	23.01
Local Competitive Bidding	13.51
Local Shopping	18.58

1/ To be revised when sub-project designs are completed.

2/ ICB = International Competitive Bidding

3/ LSH = Local Shopping

4/ LCB = Local Competitive Bidding

5/ Tentative list, subject to completion of designs.

6/ Materials in these categories required before June 30, 1976 would be procured through LSH (Schedule 4 to the Loan Agreement).

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RURAL INFRASTRUCTURE PROJECT

Schedule of Expenditures

Item	Total Cost	Calendar Years 1976	1977	1978
	----------	Won billion	----------	
1. Minor Irrigation	25.3	11.0	11.5	2.8
2. Upland Reclamation	4.4	1.0	3.0	0.4
3. Fuelwood	6.8	2.7	4.1	-
4. Roads and Bridges	3.3	2.3	1.0	-
5. Water Supply	3.6	1.8	1.8	-
6. Rural Electrification	17.3	15.3	2.0	-
7. Project Coordination, monitoring and evaluation	0.15	0.05	0.05	0.05
8. Training	0.1	0.05	0.05	--
9. Technical Assistance	0.25	0.1	0.1	0.05
Sub-total	61.2	34.3	23.6	3.3
Price contingencies				
- annual rate (%)	.	15	10	10
- compounded rate (%)	14	7.5	20	34
- amount (Won billion)	8.4	2.6	4.7	1.1
Total Project Cost - Won billion	69.6	36.9	28.3	4.4
- US$ million	143.5	77.5	56.9	9.1

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RURAL INFRASTRUCTURE PROJECT

Proposed Allocation of the Proceeds of the Loan

	Category	Estimated Total Cost		Proposed Allocation	Disbursement %
		---US$ million---			
	CIVIL WORKS[a]				
(1)	Minor Irrigation	52.2			
	Price contingency (part)	5.6			
	Sub-total:	57.8			
	Less: Vehicles and materials subject to ICB	7.1			
	Sub-total:		50.7	15.9	30
(2)	Upland Reclamation	9.0			
	Price contingency (part)	1.0			
	Sub-total:	10.0			
	Less: Materials subject to ICB	0.2			
	Sub-total:		9.8	3.8	40
(3)	Fuelwood	14.0			
	Price contingency (part)	1.2			
	Sub-total:	15.2			
	Less: Vehicles	0.5			
	Research Equipment	0.1			
	Sub-total:		14.6	4.4[b]	30
(4)	Roads and Bridges	6.8			
	Price contingency	0.4			
	Sub-total:	7.2			
	Less: Equipment	0.2			
	Sub-total:		7.0	2.5	36
(5)	Water Supply	7.5			
	Price contingency (part)	0.8			
	Sub-total:	8.3			
	Less: Materials subject to ICB	3.3			
	Sub-total:		5.0	1.5	30
(6)	Rural Electrification	35.6			
	Price contingency (part)	1.2			
	Sub-total:	36.8			
	Less: Materials subject to ICB	11.7			
	Sub-total:		25.1	6.4	25
Sub-total (carried forward)			112.2	34.5	(31% average)

	Category	Estimated Total Cost	Proposed Allocation	Disbursement %
Sub-total (brought forward)		112.2	34.5	
	MATERIALS AND EQUIPMENT SUBJECT TO ICB			
	For Minor Irrigation	7.0		
	Upland Reclamation	0.2		
	Fuelwood	0.1		
	Roads and Bridges	0.2		
	Hydrologic Services	--		
	Sub-total:	7.5	7.5	100 c/
(8)	Water Supply	3.3	2.2	d/
(9)	Rural Electrification	11.7	11.7	100 c/
(10)	VEHICLES			
	For Minor Irrigation	0.1		
	Fuelwood	0.5		
	Hydrologic Services	--		
	Sub-total:	0.6	0.6	100 c/
(11)	TECHNICAL ASSISTANCE	0.5		
	Price contingency	0.1		
	Sub-total:	0.6	0.3	e/
(12)	TRAINING	0.2	0.1	e/
(13)	PROJECT COORDINATION, MONITORING AND EVALUATION	0.3		
	Price contingency	0.1		
	Sub-total:	0.4	0.1	f/
(14)	UNALLOCATED			
	Remaining price contingency	7.0	3.0	.
Total		143.5	60.0	(42)

a/ Includes the cost of equipment and materials procured under local procedures.
b/ Includes US$3.8 million of local cost financing.
c/ The Loan would finance 100% of the cif cost of imported goods, or 100% of the ex-factory price of locally-manufactured goods.
d/ The Loan would finance 100% of the cif cost of imported goods or 30% of the ex-factory price of locally-manufactured goods.
e/ The Loan would finance 100% of foreign cost.
f/ The Loan would finance 50% of the actual costs of studies carried out by non-government or semi-government bodies.

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RURAL INFRASTRUCTURE PROJECT

Estimated Schedule of Disbursements

Bank Fiscal Year and Quarter	Cumulative Disbursements US$ million equivalent
1976	
3rd	-
4th	1.5
1977	
1st	9.0
2nd	21.0
3rd	30.0
4th	35.5
1978	
1st	43.0
2nd	51.0
3rd	55.0
4th	57.5
1979	
1st	59.5
2nd	60.0

Closing Date: June 30, 1979

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RURAL INFRASTRUCTURE PROJECT

Schedule of Critical Events

Activity	Responsibility	Critical Date
Sub-Project Selection		
i) Minor Irrigation	MAF	Completed
ii) Upland Reclamation	MAF	April, 1976
iii) Fuelwood	OOF	Completed
iv) Roads and Bridges	MHA, Provinces	February, 1976
v) Water Supply	MHSA, Provinces	Completed
vi) Rural Electrification	KECO, Provinces	Completed
Selection of 1977 program		
i) Roads	MHA, Provinces	Sept. 30, 1976
ii) Water Supply	MHSA, Provinces	Sept. 30, 1976
Completion of Design		
i) Minor Irrigation	ADC	January, 1976
ii) Upland Reclamation	ADC	May-Dec. 1976[a/]
iii) Fuelwood	OOF	March, 1976
iv) Roads and Bridges	Provinces	March, 1976
v) Water Supply	Provinces	February, 1976
vi) Rural Electrification	KECO	February, 1976
Procurement		
A. Goods subject to International Competitive Bidding		
Translate specifications	KECO	Completed
	MHSA, others	March, 1976
Advertise bids	OSROK	Feb/Mar, 1976
Evaluate bids and award contract	OSROK	Mar/April, 1976
Receive goods	KECO, MHSA, others	July, 1976[b/]
B. Goods subject to Local Competitive Bidding		
Advertise bids	OSROK	February, 1976
Receive goods	All executing agencies	May, 1976
C. Goods subject to Local Shopping		
Submit list of ceiling prices	OSROK, MHSA	February, 1976

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a/ See Annex 4, Figure 1.

b/ Goods not available at the start of the 1976 construction season would be borrowed from stock.

Activity	Responsiblity	Critical Date
Condition of Disbursement		
Execution of Subsidiary Loan	KECO, KDB & EPB	March, 1976
Technical Assistance		
Appointment of Upland Reclamation Adviser	ADC	March, 1976[a/]
Hydrologic Studies		
Establish Steering Committee	MOC	February, 1976[b/]
Invite proposals	MOC	April, 1976
Negotiate contract	MOC	June, 1976[b/]
Project Monitoring		
Establish Unit	EPB	February, 1976[c/]
First quarterly report		
- from Ministries	All Ministries	April 30, 1976
- from EPB to Bank	EPB	May 31, 1976
Project Auditing		
Submission of name and qualifications of proposed auditor	EPB	Sept. 30, 1976
Submission of audit report	Auditor, EPB	April 30, 1977
Project Evaluation		
Submit program of studies to Bank	EPB	June, 1976[b/]
Agricultural Supporting Services		
Appointment of additional extension agents	ORD, FLIA's	March, 1977
Appointment of soil conservation officers	ORD, ADC	March, 1977

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a/ Proposed legal deadline: July, 1976.
b/ Proposed legal deadline: September, 1976.
c/ Proposed legal deadline: June, 1976.

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RURAL INFRASTRUCTURE PROJECT

Project Financing

1. This Annex describes the internal financing arrangements between the government agencies concerned with the various project components. The funds to be supplied by the Bank would be mainly disbursed to the Ministry of Finance as a reimbusement for completed work (except as noted below). The financing arrangments described below for each component would, in each case, continue past practices.

Budgeting Procedures in Korea

2. The fiscal year in Korea is January 1 to December 31. Preliminary budget submissions are prepared by the various Ministries in the period February to May of the previous year. The Economic Planning Board (EPB) prepares guidelines and standards, including standard unit prices for cost estimating, and distributes these to the Ministries in April. The Ministries submit their requests to EPB by the end of June. EPB's review lasts until the end of August. Ministry requests are normally updated to the projected price levels for the following year during the July/August review by EPB. During September, the draft budget is reviewed with the Prime Minister and President and sent to the National Assembly by October 3. The Assembly normally grants final approval by the end of November. In recent years, supplementary budgets have been found necessary. These are normally approved about October. One reason for supplementary budgeting is the moderately rapid inflation which Korea has experienced in the last two years.

3. Approved budget amounts are disbursed by the Ministry of Finance to the responsible Ministry in four equal installments at the beginning of each calendar quarter. At the end of the quarter the Ministries report back on their actual expenditures. These reports show expenditures both on a conventional line item basis and on a project-by-project basis. This reporting system would be used under the project as a means of monitoring the progress of the project (para 5.15).

Minor Irrigation Component

4. Minor irrigation sub-projects would be planned by the Ministry of Agriculture and Fisheries (MAF) and financed entirely from the central government budget. Of the total project cost, 70% would be financed through a subsidy, transferred from the MAF budget to that of the Province and thence to the Farmland Improvement Association (FLIA), which would be responsible for payments to suppliers and contractors. The remaining 30% of the project

cost (US$15.7 million) would be loaned by the Government to the National Cooperative Federation (NACF) at 2% interest, with repayment over 35 years, including a five-year grace period. NACF, which is the channel for all government lending to agriculture (Annex 16), would on-lend these funds to the FLIA's at 3.5% interest and with the same repayment terms. The FLIA's would repay NACF by collecting from the beneficiaries a uniform charge per hectare, which would be included in the water charge (para 5.11).

Upland Reclamation Component

5. This component is also planned by MAF and 90% of the cost would be financed from the central government budget, of which 60% would be in the form of a subsidy, transferred from the MAF budget to that of the Province and thence to the county, which would be responsible for payments to suppliers and contractors. An additional 30% of the project cost (US$2.7 million) would be loaned by the Government to the NACF at 8% interest, with repayment over eight years, including a three-year grace period. NACF would on-lend these funds to the farmers (in practice, funds would be released directly to the county) at 9% interest and the same repayment terms. Repayments by the farmer would be made directly to the NACF. The remaining 10% of the project cost is a notional amount representing the farmers' contribution (in labor) for final landshaping and the application of fertilizers.

Fuelwood Component

6. For the fuelwood component, the Government would finance materials (mostly seedlings and fertilizer) and supervision and these costs would be fully subsidized. Labor to establish and maintain the plantations would be provided by the villagers. About 90% of project financial costs (for materials) would be allocated to the Office of Forestry, under the Ministry of Home Affairs (MHA), then to the Federation of Village Forestry Association Unions and finally to the Village Forestry Association Unions at county level, who would pay the suppliers. The remaining 10% (for supervision costs) would come from the Provincial budget.

Roads and Bridges Component

7. The roads and bridges component would be planned by MHA, at the central government level. The government would fully subsidize materials for this component (mostly cement and steel) out of funds allocated to the Provincial governments through a general revenue-sharing arrangement. Materials for bridges would be purchased (through OSROK) at the Provincial level and for roads at the county level, with funds allocated by the Province. Labor to construct and maintain the roads and bridges would be provided by the villagers.

Water Supply Component

8. Funds for the water supply component would be allocated to the Ministry of Health and Social Affairs, thence to the Provincial governments

and finally to the counties, who would pay the suppliers of materials. Materials would be provided to the villages in the form of a subsidy. In previous years, the Provinces were expected to contribute part of the cost of village water supply. There were several years when these Provincial funds were not available and cash contributions from the villagers were used instead. Under the proposed project, all necessary funds would be provided in the central government budget and the village contribution would be limited to labor for construction and maintenance and a cash contribution for operation. However, the Government intends to study ways in which the contribution of the villagers could be increased over a period of years.

Rural Electrification Component

9. The rural electrification component would be planned by the Ministry of Commerce and Industry. The government would finance 90% of the cost of this component through loans to the Korea Electric Company (KECO). The remaining 10% would be an investment by KECO from internally generated funds. The villages would also contribute some labor for construction, normally 50 man-days per village (Annex 8). IBRD disbursements for the rural electrification component (US$18.1 million) would be on-lent to KECO through the Korea Development Bank (KDB) under a Subsidiary Loan Agreement, at 7.5% interest and would be repayable over 35 years. Government disbursements (US$13.1 million) would be lent to KDB (as the legal channel for Government lending to "industry") at 6% interest and would be repayable over 35 years, including a five-year grace period. These funds would be on-lent to KECO at 7.5% interest and under the same repayment terms. KECO would procure all materials through OSROK and would pay all suppliers and contractors. KECO would recover the project capital cost from the consumers by means of a fixed monthly assessment, based on the average cost of connecting each household to the system but differentiated according to the number of light bulbs used.

Other Components

10. The other components included in the project, namely, monitoring and evaluation, training, technical assistance, and improvements to hydrologic services would be carried out by central government agencies and the local costs would be met by regular budgetary allocations to these agencies. Foreign costs of training and consulting services would be financed directly from the Loan. The Bank would also reimburse local costs (up to US$100,000) of the project evaluation unit (para 5.18), disbursements being made as a percentage of the cost of studies carried out by non-government bodies (such as universities) or semi-government agencies (such as the Korea Development Institute).

KOREA

RURAL INFRASTRUCTURE PROJECT

Agriculture

1. In this Annex, some basic information is given on the recent performance of the agriculture sector in Korea 1/, in order to demonstrate the high priority of the minor irrigation and upland reclamation components of the project. A description is then given of general agricultural conditions in the proposed sub-project areas and of the agronomy of the major crops. Finally, constraints on production, the extent to which these would be removed by the minor irrigation and upland reclamation components of the project, and projected agricultural conditions at full project development are discussed. Information on agricultural supporting services is given in Annex 16, while farm budgets and economic analysis are discussed in Annexes 17 and 18.

A. The Agriculture Sector

Agriculture's Role in the Economy

2. Agriculture plays a major role in the economy of Korea, as shown by the following table (in which forestry and fisheries are excluded):

Agriculture's Share of the Economy

Year	Share of Employment (%)	Share of GNP (%)	Agricultural Trade Balance (US$ million)	Agricultural Share of Total Imports (%)
1961	66.7	40.0	-82	32
1966	57.5	36.0	-95	20
1971	48.5	28.8	-230	12
1974	49.0	27.3	-623	9

Agricultural employment has stabilized in recent years at about half of all employment, though its share of GNP is considerably lower. While agricultural imports (mainly of foodgrains) have greatly expanded in absolute amounts, they have declined as a proportion of total imports.

1/ More detailed information is given in the Bank's "Agricultural Sector Survey" of 1973 and in the Economic Report of 1975.

3. Although the economic growth of Korea in recent years has been very high (para 2.03), progress in agriculture has been less dramatic, with an average real growth rate of value added in this sector of about 3.5% during 1962-72. Growth accelerated in 1973 and 1974 to 5.5% and 6.9%, respectively, but this was mainly due to rapid growth in the livestock and fisheries subsectors. Total foodgrain production (including potatoes and soybeans) has grown little in the last decade, standing at about 7.2 million tons, the steady rise in rice production being counterbalanced by declines in the output of barley, wheat and potatoes. Land devoted to the latter crops has been gradually converted to rice paddies, to high-value cash crops (fruit, vegetables, tobacco and mulberry for silkworms) or to urban uses.

Agricultural Self-Sufficiency

4. As a result of Korea's inability to increase its domestic production of basic foodstuffs, total imports of the major food grains have increased from 500,000 tons in 1962-4 to 2.7 million tons in 1972-3 (Table 1), equivalent to a decline in the degree of self-sufficiency from 90% to 70%. The cost of imported grain in 1974 was US$640 million. Prospects for reversing this trend are only moderately good, as demand is increasing at 2.5% per year and the supply of cultivable land is quite limited. Increased domestic production thus implies increased yields and cropping intensities and the conversion of uplands into cultivable land.

5. The Government's policy is to achieve a greater degree of self-sufficiency, particularly in the staple grains, rice and barley, and thus free Korea from dependence on unstable world markets. For rice and barley, this goal appears attainable within a few years, as the degree of self-sufficiency is already high (about 90%) and per capita demand is levelling off (Table 1). However, consumer demand is becoming more diversified, as shown by the rapidly rising consumption of wheat, and there is little likelihood of achieving self-sufficiency in this grain, due to climatic limitations (para 25). For the remaining crops (potatoes, soybeans, vegetables, fruits and others), growth in production will depend primarily on pricing policy and the development of upland areas. There is also a need to increase the cropping intensity on upland areas, which actually declined from 171% in 1961 to 140% in 1971. The probable reasons for this are the low prices for barley during this period and the technical design of upland development (discussed in more detail in Annex 4).

Development Policies

6. The Government's planning in the agricultural sector includes both intensification of production on existing cropland, through improved and expanded irrigation and drainage and a greater use of inputs, and also expansion of the cropped area. The Government's targets for 1981 are as follows:

(a) Development of new water resources -- an additional 150,000 ha are scheduled to be irrigated by 1981;

(b) Construction, or improvement, of drainage systems on about 140,000 ha of low-lying paddy lands, suffering from drainage problems;

(c) Land rearrangement and land consolidation on about 290,000 ha, to improve productivity and facilitate mechanization;

(d) Development of new lands (upland reclamation and reclamation of tidal flats) totalling about 120,000 ha;

(e) Intensification of the use of inputs, such as, fertilizers, farm machinery, and high-yielding varieties; and

(f) A policy of high prices to provide incentives to the farmers.

The Project Components

7. The proposed minor irrigation and upland reclamation components of the project would form an integral, though relatively small, part of the Government's overall program to increase food production. The irrigation component is equivalent to 8% of the total planned investment in new irrigation systems by 1981, while upland development forms 4% of the 1981 target.

8. The present agricultural conditions in the sub-project areas are described in the following paragraphs. As both components consist of fairly small and widely scattered areas and no agro-economic survey has been made, the discussion is necessarily fairly generalized and national averages will frequently be used to represent sub-project area conditions. An important exception to this approach is the division of the minor irrigation component into three geographic areas, as follows:

Area	Name	Provinces
I	North	Gyeong-gi Gang-weon Chungcheong Bug
II	Southwest	Chungcheong Nam Jeonra Bug Jeonra Nam
III	Southeast	Gyeongsang Bug Gyeongsang Nam

The location of these areas can be seen from Map 10375. Where necessary, separate assumptions are made about present and future cropping conditions in each area (para 17). For the upland reclamation component, most of the sub-projects would be located in the west coastal areas and the projections of future conditions are more uncertain than for irrigation, because of the proposed adoption of new design standards (Annex 4). For these reasons, no attempt was made to analyse the impact of the upland component by regions.

B. Present Conditions

Land Use

9. Land use for Korea as a whole is described in Annex 1. As paddy lands in the coastal plains and the more accessible areas have already mostly been irrigated, the minor irrigation sub-project areas tend to be in the smaller and more remote valleys. Canals which are laid out to serve these smaller valleys can also conveniently command some upland areas adjacent to the paddy lands. Such uplands (which are nearly all cultivated at present) would be terraced into paddy fields, when less than 6% slope. This conversion has been allowed for in evaluating the minor irrigation component. For upland reclamation sub-projects, on the other hand, the present land use is mostly as forest for fuelwood production.

Climate

10. The general features of Korea's climate are discussed in Annex 1, which also gives average monthly temperatures for a number of cities. The following four climatic factors have an important bearing on the cropping potential:

(a) The number of frost-free days varies from 175 to 220, as one travels from the north to the south of the Republic of Korea. Therefore, two crops of rice are not possible;

(b) The cold winter season allows cropping of only tolerant crops such as winter barley or wheat and a few minor crops, such as onions and rape;

(c) The total rainfall is generally sufficient but its distribution tends to be erratic (particularly in the South), demonstrating a need for supplemental irrigation; and

(d) Light intensity during the warm, cloudy summer season may be a limiting factor for maximum yields.

Agricultural Techniques

11. As the average farm size is only 0.9 ha in Korea (including 0.5 ha of paddy land), agriculture is highly labor intensive, despite relatively high wage rates. Land preparation is done mostly by draft bullocks or by hand. Four-wheeled tractors are practically unknown (there being less than 300 in the whole of Korea in 1974) and the number of power tillers is not great (38,000 in 1974). However, these tillers are used far more extensively for pulling trailers than for cultivation. The reason for this appears to be that the purchase of power tillers is subsidized whereas conventional haulage vehicles are heavily taxed. Pesticides are mostly applied by hand sprayers or hand dusting but powered and hand-operated pump sprayers are increasing. Neighbors cooperate in the purchase and use of these. Threshing is done mostly by foot-pedal or powered rotational threshers, though small stationary powered threshers are now coming into wider use. Input use is discussed in the following paragraphs. The assumed rates of use were assumed to vary with climatic zone and with farm size. A typical example (Area II, Farm 2) is shown in Table 7.

Fertilizers and Lime

12. As a result of a national policy of subsidizing the cost of fertilizer, consumption in Korea has almost doubled to about 2 million tons during the last decade. The Government has made large supplies available at low prices (whcih are uniform throughout the country). In 1974, the subsidy element averaged 40% of total costs. In December 1975, however, prices were increased by an average of about 70%. Due to limited credit funds (Annex 16), credit is available only for one-third of the total fertilizer sold. Transportation and storage are adequate to ensure timely distribution of fertilizer.

13. Urea is widely used as a source of nitrogen and ammonium sulphate is also used. Rock phosphate would be useful on the highly acid upland soils and its use may increase if prices become more favorable, compared to processed phosphate. Several mixed NPK fertilizers are available. Most of these contain equal amounts of each element but some vary -- being usually lower in K than in N or P. Average present rates of fertilizer use for the sub-project areas are shown in Table 2, which also includes projected use at full development. Under the pricing structure which was obtained in 1975, a yield response of as little as 2 to 3 kg rice/kg nutrient was profitable and thus there is little doubt that farmers will continue to apply the additional amounts forecast. Progressive farmers already use fertilizers heavily, for example, 200 kg N/ha for rice, plus other nutrients. For upland crops, prices are not as favorable and therefore rates of use have been projected at lower levels than recommended by the extension service. Composted agricultural residues are a significant source of fertilizer, especially for the smaller farms. One result of the fuelwood component of the project would be an increase in the amount of residues available for composting (Annex 5).

14. The acidity of most upland soils in Korea reduces the yields of barley, wheat, legumes (especially soybeans) and some vegetables (Annex 4). Correction of soil acidity is required before proper response can be obtained from fertilizers, particularly for phosphate on legumes. The use of agricultural lime to correct soil acidity was 500,000 tons in 1971, which was an almost three-fold increase over the usage in 1966 and the result of a government program in which lime is supplied free of charge. However, the high cost of transport and the difficulties of access have limited the use of lime on upland areas to about half the desirable rate (Annex 4). The access constraint would be removed for the sub-project areas, as access roads would be an integral part of the minor irrigation and upland reclamation components.

Plant Protection

15. The use of chemicals to control plant diseases and insects has increased greatly in recent years, parallel to the growth of fertilizer use. The quantity of pesticide used in 1973 was about three times as large as in 1967. Insect pests and diseases of crops are monitored by research personnel and recommendations for control are released to the extension workers. The amount of plant protection undertaken varies greatly from crop to crop. Rice farmers use four to six applications per season for control of stemborers and blast disease. Chemicals are applied preventively rather than as a response to outbreaks of pests or diseases. Other high-income crops, which also have a high disease potential, such as chinese cabbage, red peppers and fruit trees, receive a moderate degree of plant protection. On the other hand, some low-value crops (such as barley, wheat, garlic and sesame) receive little or no pest control. Soybeans receive very little care as far as plant protection is concerned, despite potentially serious insect problems. If soil acidity were fully corrected and fertilizer used on soybean, improved yields would result, and more attention would be given to the use of plant protection chemicals. Chemicals for weed control are not widely used in Korea. There is a need for more herbicides on upland crops, for which the hand weeding commonly used in the rice fields would not be economic.

Seeds

16. The present system for multiplying and distributing seeds, as well as improvements now under way, is described in Annex 16. The availability of quality seeds is not expected to a major constraint on increased production in Korea.

Present Cropping Pattern - Minor Irrigation

17. Because the cropping pattern and the cropping intensity vary in different parts of Korea, three regions were used for analysis (para 8). The regions differ in the number of frost-free days, as well as in the hours of sunshine and the average temperature. The most striking effect of these climatic differences is on the present degree of double cropping of rice with barley, which varies from 5% in Area I (North) to 20% in the other two Areas (Map 10447).

18. The assumed present cropping patterns for Areas I, II and II are shown in Tables 3, 4 and 5 respectively. The cropping pattern for the project area as a whole is given in Table 6. The cropping calendar is shown schematically in Figure 1. The analysis is based on whole farms and thus includes not only the paddy land to be irrigated and associated upland areas to be converted to rice paddies as a result of the project, but also other upland areas owned by the project beneficiaries. The latter areas would not be physically affected by the project but would experience a change in cropping pattern (para 39). Thus the gross project area is assumed to be 21,700 ha, of which 9,400 ha is presently in rice paddies. The overall cropping intensity varies from 129% in Area I to 156% in Area III, or an average of 141%. The slight discrepancy between the total irrigable area, as described in this Annex and that shown in Annex 3, Table 1 is due to changes in the sub-project list after the evaluation was completed. Data on cropping patterns were obtained from MAF national and provincial statistics, MAF estimates for the sub-project areas and field observations.

19. Cropping in Korea is very diversified and the use of ten crops in the project economic and farm budget analyses is actually an underestimate of the diversification on most small farms. The crops shown should therefore be thought of as representing groups of crops with similar growing conditions and returns per ha. "Traditional rice" comprises a variety of local types, including some improved varieties, but excluding high-yielding varieties, which are labelled "Improved rice." "Barley" includes both the common and naked types (para 26), both of which are widely grown, and also wheat. "Chinese cabbage" also represents radishes and a variety of other vegetables, such as cucumbers, melons, garlic and onions. Specialized cash crops, such as mulberry and ginseng, while widely grown and very profitable, require special agronomic and marketing conditions and thus were not considered in the cropping pattern. Some important agronomic data is given below for each of the major crops considered in the cropping pattern.

20. Rice - Korea has about 1.2 million ha of paddy land (Annex 1). As the return from rice growing is much greater than from any other cereal, Korean farmers tend to grow rice wherever climatic, topographic, soil and water control conditions permit. Planted area has increased little in the last decade but yields have steadily increased, due to improving management, increasing irrigation and the release of high-yielding varieties. As rice is Korea's staple food and the country is a net rice importer, no marketing problems are foreseen. Processing facilities are expected to expand in line with project output.

21. Yields of rice in Korea are double those in Southeast Asia but about 20% less than in Japan, leaving some margin for improvement. Korean farmers use moderate to high rates of fertilizer, high levels of plant protection chemicals and good management practices. Some very good yields of rice are obtained with high-yielding varieties (HYV's). Constraints on yields are discussed in para 37. There are many traditional rice varieties cultivated in Korea, almost all of which are variants of Japanese varieties. These varieties are medium in height and have a fair yield potential and good grain quality. Five of these traditional varieties predominate, with "Akibare" the

most popular, especially in taste and quality. About 4% of the rice area is taken up by glutinous or "sticky" rice used for making rice cakes.

22. In 1971-72, one of the new short, stiff-strawed and nitrogen-responsive rice varieties was made available to farmers in Korea. Indica (tropical) HYV's had been introduced earlier but this was the first of the Japonica (temperate zone) HYV rices. The variety, which is a cross involving IR8 and TN-1 of the Indicas with Yukara, a Japonica type, was designated IR 667 but became popularly known in Korea as "Tongil". By 1975, Tongil was reported to have spread to 25% to 30% of the total paddy area. Higher rates of fertilizer are used on this type than on the older varieties. Some farmers report a 30% increase in yield. National goals are for Tongil and other new HYV's to occupy two-thirds of the rice area by 1980. Considering the good reception Tongil has experienced with Korean farmers and the continuing improvement of irrigation, this goal is realistic.

23. Rice researchers are working on other HYV's for future release. Tongil does not have the quality of the local varieties. Future varieties will be developed for higher quality and better disease resistance (Tongil does show good blast resistance in Korea). Early maturity is also a goal of the plant breeders, so as to increase the potential for double cropping. Four new rice varieties were released to farmers in 1975. One, called "Tongilchal", is glutinous and should replace the old lower-yielding glutinous rices. The others are listed below:

Variety	Features	Area of Use
Early Tongil	Two weeks earlier maturity than Tongil	Whole country
Yushin	Highest yield	Southern area
Milyang 21 or 23	Early maturity	Southern area

24. Korean farmers are well informed on new developments in rice production. Local experimental plots exhibit the new varieties, as well as demonstrating proper spacing and other cultural practices. These plots have billboards describing the demonstration, as well as the objectives of the sponsoring county or district.

25. Barley - The dominant winter crop is barley, though wheat is grown on about 10% of the grain area in the southern parts of the country. Barley is grown both on paddy land and as an upland crop. Despite the better yield potential of wheat, and the higher consumer demand, its later maturity limits its use in rotation with rice. The potential for double-cropping on paddy land is not only a function of climate but also requires reasonably early-maturing varieties of both rice and barley. Early-maturing rice ensures that barley can be planted before the first frosts. An early-maturing barley is needed to permit harvest before the onset of the rainy season. An additional constraint in much of Korea is the difficulty of draining the paddy fields to allow land preparation for barley. This often

results in inadequately prepared seedbeds and, consequently, uneven germination, growth and yield. Despite moderately high rates of fertilizer use, barley yields are lowered by the fact that irrigation water is always conserved for the rice crop, rather than being used to assist the barley crop in the critical growing and ripening phases. For these reasons, and also a price which gives the farmer little incentive to use inputs, barley yields in Korea are not high.

26. There are two types of barley used in Korea: regular or common winter barley, with the husks attached to the kernel after threshing; and naked barley, where the husk is removed in threshing. Naked barley is grown in the central and southern regions. As the inputs used on both crops are similar and yields, when expressed on a polished basis, are also similar, the two barley types have been combined in the present analysis. By Government regulation, polished or "pearled" barley is mixed with rice in the Korean diet (up to 30%). About 350,000 tons of barley is imported, so inincreased production due to the project would pose no marketing problems. As storage and processing requirements of this crop are "opposite season" to the main crop of rice, they would be easily handled.

27. Varietal improvement on barley is conducted at three experiment stations. The objectives of the programs are for early maturity, stiff straw, disease resistance and wet soil tolerance, among other things. The following varieties were recently released: "Olberi" ("Barsoy"), which has early maturity and a yield potential of 5 ton/ha; "Cannon 89", a wet soil tolerant variety; and "Sukai 175", an early maturing variety with stiffer straw and a good yield. It is expected that there will be 200,000 ha of Sukai 175 planted in 1976.

28. Soybeans - Production of soybeans ranks only behind rice, barley and potatoes in Korea. Soybeans are important in the Korean diet and over 70,000 tons are presently imported each year. Yields are low, varying by Province from 0.8 to 1.1 ton/ha. Soybeans are mostly planted after barley on upland soils but they are also planted in many "fill-in" areas such as along roads, rice levees, and canal banks. There is a national program to increase soybean production and become self-sufficient but this is unlikely to be successful if present low yields continue and other crops remain more profitable.

29. The plant breeder's goals for soybeans are to improve existing varieties with regard to oil content, versatility of use, disease and insect resistance, and growth characteristics. Several hundred introductions are being tested and wild species are being used for crosses. There are 13 recommended varieties in Korea and these cover all the varied climates and soils. In 1974, 95% of all the crop area was sown either with developed or introduced varieties and the remainder with local types. Some improved varieties have a potential yield of 2.5 ton/ha. With the present varieties and cultural knowledge, a national average soybean yield of 1.5 ton/ha is attainable. The main problem with soybeans in Korea is soil acidity (Annex

4). When this is corrected with lime, fertilizer responses can be realized. At present the use of fertilizer on soybeans is negligible. When lime and fertilizer have been used on the available improved varieties, more attention will be paid to insect and disease control and moderate to high yields obtained.

30. Potatoes - The cropping pattern includes both white (Irish) potatoes and sweet potatoes. A breeding program was started in 1965 to develop improved white potato varieties with early maturity, high yield, disease resistance and a high starch content. Yields average about 11 ton/ha now. The current yield potential is 15 ton/ha but breeding targets plan to achieve 20 ton/ha. White potatoes are grown in all Provinces, especially in Gang-weon Province.

31. The sweet potato has gained prominence in the agricultural economy only since about 1960. Formerly unused uplands were dug up and planted to sweet potatoes in the summer and barley in the winter. This form of cultivation accounted for 30% of the increase in the cultivated upland areas in the 1960-70 decade (Annex 4). Consumption of sweet potatoes helped build up the caloric intake and alleviate food shortages following the Korean War. More recently, the government has erected factories to manufacture starch and glucose, with sweet potatoes replacing molasses (from imported sugarcane) in the manufacture of alcohol. There are 24 such factories in the country. An expanded output of both potato crops could easily be utilized in Korea. The Government is negotiating with USAID for a crop research project, which would have potatoes as a major focus.

32. Chinese Cabbage and Radish - About half Korea's vegetable production consists of Chinese cabbage and long white radishes. Both are used for making kimchee, a staple pickled food consumed by all Koreans at all meals. The yields and returns for these crops are good and thus they receive high rates of fertilizer and plant protection chemicals and are well cared for by the farmers. A steady growth in demand, paralleling population growth, may be expected. Both cabbages and radishes are short-duration crops and they are usually planted in the mid- to late-summer months, following a spring vegetable or another crop. They can also be planted in early-spring and two crops obtained in the summer season.

33. Red (chilli) Pepper - Red peppers are widely grown in Korea and occupy about 20% of the upland area. They are used in making "kimchee" and to season many other foods in the diet. The crop has the problem of wide variations in production from year to year, with corresponding price fluctuations. The return on the crop is good if the price is not depressed. A recently released variety, that has greatly reduced "blossom drop" compared to former varieties, gives promise of marked yield increases. Farmers use good fertilizer rates with red peppers and the crop receives good management. Many fields are "bedded-up" and the beds covered with plastic, for moisture conservation and erosion control. Red peppers use almost a full summer season in the cropping calendar but sometimes can be followed by a crop of cabbage or radishes.

34. Sesame - This is another crop that is grown widely in Korea, occupying about 30% of the upland area. The area shown includes a few minor oilseed crops (such as rape, sunflower and castor). There is a good demand for sesame, the seed being used as an edible seed and its oil as a valued cooking oil. The price for sesame is good but yields of this crop are inherently low, with little potential for increase.

35. Tobacco - This crop can only be grown under a contractual arrangement between the farmer and the Office of Monopoly. It is usually grown by the larger farmers and occupies about 8% of the upland area. It requires large amounts of inputs and labor but is a profitable crop to the farmer. As the demand for tobacco is good, production is expected to increase gradually over the next decade (national goals are for an 11% annual increase). Korea is one of the few countries which grows a light Virginia-type tobacco. In the late 1960's, Korea built up tobacco exports in addition to supplying its growing domestic market for cigarettes. Production is now over 32,000 tons and Korea ranks behind only the USA, India, Rhodesia and Canada in the world tobacco trade.

Present Cropping Pattern - Upland Reclamation

36. The sub-project areas for upland reclamation are uncultivated at present, being covered with grass and forest of low productivity. Their major value at present is for fuelwood production.

C. Constraints on Production

Minor Irrigation Sub-Project Areas

37. Present production on these rainfed rice (plus associated upland) areas is constrained by the following major factors, several of which would be removed by the project:

(a) Lack of Water Control means that droughts before and during the rice planting season often lead to reduced and delayed plantings, reduced yields and possible elimination of a following barley crop, because of the onset of cold weather. Droughts during the grain filling period also reduce yields. Lack of water control may reduce the potential yield of HYV's of rice. The water control constraint would be largely removed for the sub-project areas by the provision of irrigation and the improvement of local drainage. Irrigation of upland crops is practiced at present only on small areas in Korea and not included in the project.

(b) Constraints on Double Cropping include poor drainage, which delays barley planting and reduces yields and the very tight cropping calendar (para 25). The latter constraint would be

eased by the expansion of earlier-maturing HYV rice, facilitated by the project. However, further research on early-maturing rice and barley varieties will also be needed. The development of an early-maturing high-yielding wheat variety would be invaluable in helping to meet the strong demand for this grain. Irrigation of barley would improve yields but, heretofore, farmers have been reluctant to release irrigation water before the rice planting season. Improvements in the design of storage reservoirs resulting from the hydrologic studies included in the project may result in water being available for barley irrigation at a future time.

(c) Labor Availability is only a constraint at the peak seasons at present. Although the development of minor irrigation would increase the total labor demand, some easing of peak demands could result, as the cropping pattern would become more diverse, since some of the traditional rice varieties would be replaced with earlier-maturing HYV's. With the project, planting dates for rice would be much more under the control of the farmer and could thus be adjusted to suit local labor conditions. Labor constraints are likely to be more significant for low-value crops (such as barley and soybeans), for which hired labor is not financially justified. No immediate increase in mechanization is assumed but it might be expected that, in five to ten years' time, wage rates in Korea will have risen to the point where small-scale mechanization (similar to that used in Japan) will be appropriate. Sprinkler irrigation of uplands is also likely to develop.

(d) Extension and Credit appear to be only minor constraints (Annex 16).

Upland Reclamation Sub-Project Areas

38. The very low present productivity of these areas is the result of the following factors:

(a) Lack of Land Development. Due to their slope and acidity and low water-holding capacity of their soils (Annex 4), successful cropping of these areas requires extensive land development, which is generally beyond the financial capability of the owners. Bench terracing, under the project, would allow a diverse cropping pattern and would help to retain soil moisture. Lime treatment to correct acidity would be included in the project.

(b) Lack of Access eliminates the growing of high-value crops such as fruits and vegetables, which are heavy and perishable. Such access would be provided under the upland reclamation component.

Even with the project, the following constraints would remain to some degree:

(c) Labor Availability will be a critical constraint where farm sizes are large. Farm size has therefore been used as a factor in sub-project selection (Annex 4).

(d) Extension and Credit needs would be much greater than in the minor irrigation component. Improved extension is provided for in the project (Annex 16). The availability of credit would be assessed during the selection and design of each sub-project.

D. Future Conditions

Future Cropping Pattern - Minor Irrigation

39. The projected future cropping patterns for Areas I, II and III, and for the project area as a whole, are shown in Tables 3 to 6. The future cropping calendar is shown schematically in Figure 1. The effect of the minor irrigation component would be to increase the paddy area (due to conversion of upland) and the proportion of HYV rice. For the reasons outlined in para 37, double cropping with barley would increase (to 20% of the paddy land in Area I and to about 60% in the other two areas). In the associated upland areas, which would be reduced in size following the project, it has been assumed that farmers would attempt to maintain the areas of their high-value crops (such as tobacco and vegetables) and reduce the area of upland barley, soybeans and sesame. The overall cropping intensity at full project development would range from 140% to 164%, or an average of 151%.

Future Cropping Pattern - Upland Reclamation

40. The projected cropping pattern for the upland reclamation component is shown in Table 8. Two alternative patterns -- with and without fruit -- are shown. The projected cropping pattern is similar to that for the upland portion of the minor irrigation component, with the provision that high-value crops constitute at least 35% of the area (which is suggested as a sub-project selection criterion in Annex 4) and with the addition of pasture and fruit as additional crops, for the steeper areas. Apples have been used to represent all orchard crops (which actually include pears, peaches and grapes).

Yields [1/]

41. Present yields were derived from MAF records, checking with Provincial and County ORD and ADC offices plus farmer interviews. Additional

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1/ All yields of rice or barley are expressed on a milled or polished basis.

sources were used in assessing rice yields. With this crop, the long range effects of droughts on rainfed yields were taken into consideration, following work done by a consultant (Tahal, Israel) for the proposed Ogseo Irrigation Project. Under this approach, the probability of drought at each stage in the growth cycle of rice is assessed from historic records and combined with data on the effect on yield of water deficiencies at these periods. The result for an area under rainfed cultivation (with possibly some crude local irrigation) is a long-term average yield of 2.5 ton/ha for traditional varieties, which is somewhat below previously published figures. Some variation between regions was assumed.

42. Present yields and projected future yields, with and without the project, are shown in Tables 3 to 6 and 8. It was assumed that, without the project, yields would show a modest increase, due to continuing extension work and the release of improved varieties. With the project, projected yields are based on general conditions (plus a small increasing trend) in irrigated areas of Korea, for the minor irrigation component, and for well-designed and maintained upland reclamation projects. All yields are substantially below those obtained by the best farmers, indicating a margin for future improvement.

KOREA

RURAL INFRASTRUCTURE PROJECT

Production, Net Imports, and Consumption of the Major Food Grains

	1961	1966	1970	1971	1972	1973	1974
	'000 ton						
Production							
Rice	3,047	3,501	4,090	3,939	3,954	4,211	4,445
Barley	1,478	2,018	1,974	1,858	1,971	...	...
Wheat	280	315	357	322	244	...	...
Total	4,805	5,834	6,421	6,119	6,169	6,164	6,296
Net Imports							
Rice	-	31	541	1,004	495	437	206
Barley	123	-	-	-	387	350	200
Wheat	355	503	1,254	1,672	1,900	1,835	1,592
Total	478	534	1,795	2,676	2,782	2,622	1,998
Per Capita Consumption	kg						
Rice	119	127	130	150	144	143	139
Barley	60	64	60	62	64	...	...
Wheat	24	21	50	55	73	...	...
Total	203	212	240	267	281	270	248

ANNEX 15
Table 1

KOREA

RURAL INFRASTRUCTURE PROJECT

Fertilizer Application Rates for Selected Crops[1/]

Crop	Nutrient Use					
	Present Use			Future with Project		
	N	P_2O_5	K_2O	N	P_2O_5	K_2O
	kg/ha					
Improved Paddy	137	75	55	150	80	60
Traditional Paddy	116	55	35	128	65	45
Barley[2/]	115	50	45	125	60	60
White Potato	107	70	70	125	70	80
Soybean	20	30	20	60	90	60
Tobacco	90	110	120	105	115	125
Red Pepper	160	70	70	185	80	80
Sesame	40	30	20	60	40	30
Chinese Cabbage	180	100	100	205	120	125
Sweet Potato	40	30	20	90	70	45

1/ Average for the three areas.

2/ Same figures for common and naked barley.

KOREA

RURAL INFRASTRUCTURE PROJECT

Minor Irrigation Component

Cropping Pattern, Yield and Production - Area I (8,700 ha)

Crop	Present				Future Without Project				Future With Project			
	Cropping Pattern %	'000 ha	Yield 1/ ton/ha	Production '000 tons	Cropping Pattern %	'000 ha	Yield 1/ ton/ha	Production '000 tons	Cropping Pattern %	'000 ha	Yield 1/ ton/ha	Production '000 tons
Paddy Land												
Improved Rice	5	0.4	2.8	1.1	15	1.3	3.0	3.9	50	4.3	3.9	16.8
Traditional Rice	40	3.5	2.4	8.4	30	2.6	2.6	6.8	20	1.7	3.4	5.8
Barley	2	0.2	1.9	0.4	4	0.4	2.0	0.5	15	1.2	2.2	2.6
Sub-total: Land Area	45	3.9			45	3.9			70	6.0		
Sub-total: Cropped Area	47	4.1			49	4.3			84	7.2		
Cropping Intensity (Paddy)	105				110				120			
Upland												
Barley	23	2.0	1.9	3.4	26	2.2	2.0	4.4	20	1.8	2.2	4.0
White Potato	3	0.3	11.0	3.3	3	0.3	12.0	3.6	3	0.3	14.0	4.2
Soybean	16	1.4	0.8	1.1	16	1.4	0.9	1.3	5	0.4	1.1	0.4
Tobacco	4	0.3	2.0	0.5	4	0.3	2.0	0.6	3	0.3	2.0	0.6
Red Pepper	10	0.9	0.8	0.7	10	0.9	0.9	0.8	8	0.7	1.0	0.7
Sesame	14	1.2	0.5	0.6	14	1.2	0.6	0.7	4	0.3	0.7	0.2
Chinese Cabbage	7	0.6	14.0	8.4	7	0.6	16.0	9.6	7	0.6	18.0	10.8
Sweet Potato	5	0.4	16.0	6.4	5	0.4	17.0	6.8	5	0.4	19.0	7.6
Sub-total: Land Area	55	4.7		34.3	55	4.6		39.0	30	2.4		53.7
Sub-total: Cropped Area	82	7.1			85	7.3			55	4.8		
Cropping Intensity (Upland)	149				157				183			
Total: Land Area	100	8.6			100	8.5			100	8.6		
Total: Cropped Area	129	11.2			134	11.6			140	12.0		
Overall Cropping Intensity	129				134				140			

1/ Rice and barley yields are on a milled and polished basis respectively.

ANNEX 15
Table 3

KOREA

RURAL INFRASTRUCTURE PROJECT

Minor Irrigation Component

Cropping Pattern, Yield and Production - Area II (8,600 ha)

Crop	Present				Future Without Project				Future With Project			
	Cropping Pattern %	'000 ha	Yield 1/ ton/ha	Production '000 tons	Cropping Pattern %	'000 ha	Yield 1/ ton/ha	Production '000 tons	Cropping Pattern %	'000 ha	Yield 1/ ton/ha	Production '000 tons
Paddy Land												
Improved Rice	5	0.4	3.1	1.2	15	1.3	3.3	4.3	40	3.4	4.2	14.3
Traditional Rice	40	3.4	2.7	9.2	30	2.6	2.8	7.3	20	1.7	3.5	6.0
Barley	9	0.8	2.0	1.6	11	1.0	2.2	2.3	23	2.0	2.5	5.0
Sub-total: Land Area	45	3.8			45	3.9			60	5.1		
Sub-total: Cropped Area	54	4.6			56	4.9			83	7.1		
Cropping Intensity (Paddy)	120				125				140			
Upland												
Barley	33	2.6	2.0	5.2	28	2.4	2.2	5.3	26	2.3	2.5	5.7
White Potato	3	0.3	12.0	3.6	3	0.3	14.0	3.4	3	0.3	15.0	4.5
Soybean	16	1.4	0.8	1.1	15	1.3	1.0	1.3	7	0.6	1.2	0.7
Tobacco	4	0.3	2.0	0.6	4	0.3	2.0	0.6	4	0.3	2.0	0.6
Red Pepper	10	0.9	0.8	0.7	10	0.9	1.0	0.9	11	0.9	1.1	1.0
Sesame	15	1.3	0.5	0.6	15	1.3	0.6	0.8	6	0.5	0.7	0.3
Chinese Cabbage	7	0.6	15.0	9.0	8	0.7	17.0	11.7	9	0.8	19.0	15.2
Sweet Potato	5	0.4	17.0	6.8	5	0.4	18.0	7.2	5	0.4	20.0	8.0
Sub-total - Land Area	55	4.6		39.5	55	4.5		44.9	40	3.3		61.4
Sub-total - Cropped Area	101	7.8			104	7.6			71	6.1		
Cropping Intensity (Upland)	169				169				178			
Total: Land Area	100	8.4			100	8.4			100	8.4		
Total: Cropped Area	145	12.4			149	12.5			157	13.2		
Overall Cropping Intensity	145				149				157			

1/ Rice and barley yields are on a milled and polished basis respectively.

ANNEX 15
Table 4

KOREA

RURAL INFRASTRUCTURE PROJECT

Minor Irrigation Component

Cropping Pattern, Yield and Production - Area III (4,400 ha)

Crop	Present				Future Without Project				Future With Project			
	Cropping Pattern %	'000 ha	Yield[1/] ton/ha	Production '000 tons	Cropping Pattern %	'000 ha	Yield[1/] ton/ha	Production '000 tons	Cropping Pattern %	'000 ha	Yield[1/] ton/ha	Production '000 tons
Paddy Land												
Improved Rice	5	0.2	3.1	0.7	15	0.7	3.3	2.3	44	2.2	4.2	9.2
Traditional Rice	40	1.8	2.7	4.9	30	1.3	2.8	3.9	23	0.4	3.5	1.5
Barley	9	0.4	2.0	0.8	11	0.5	2.1	1.0	38	1.3	2.5	3.2
Sub-total: Land Area	45	2.0			45	2.0			67	2.6		
Sub-total: Cropped Area	54	2.4			56	2.5			105	3.9		
Cropping Intensity (Paddy)	120				125				150			
Upland												
Barley	40	1.8	2.0	3.6	39	1.7	2.1	3.6	40	1.3	2.5	3.4
White Potato	5	0.2	12.0	2.4	5	0.2	13.0	2.6	5	0.2	15.0	3.0
Soybean	15	0.7	0.8	0.6	15	0.7	1.0	0.7	5	0.3	1.2	0.4
Tobacco	3	0.1	2.0	0.3	3	0.1	2.0	0.2	3	0.1	2.1	0.2
Red Pepper	8	0.4	0.8	0.3	8	0.4	1.0	0.4	8	0.4	1.1	0.5
Sesame	12	0.5	0.5	0.3	12	0.5	0.6	0.3	3	0.2	0.7	0.1
Chinese Cabbage	12	0.5	17.0	8.5	12	0.5	18.0	9.0	9	0.6	21.0	12.6
Sweet Potato	6	0.3	18.0	5.4	6	0.3	19.0	5.7	6	0.3	21.0	6.3
Sub-total: Land Area	55	2.4		27.8	55	2.4		29.7	33	1.8		40.4
Sub-total: Cropped Area	103	4.5			105	4.4			62	3.4		
Cropping Intensity (Upland)	185				183				188			
Total: Land Area	100	4.4			100	4.4			100	4.4		
Total: Cropped Area	156	6.9			156	6.9			164	7.3		
Overall Cropping Intensity	156				156				164			

1/ Rice and barley yields are on a milled and polished basis respectively.

KOREA

RURAL INFRASTRUCTURE PROJECT

Minor Irrigation Component

Agricultural Production - Total Area (21,700 ha)

Crop	Present		Future Without Proj.		Future With Project		Incremental
	Area	Production	Area	Production	Area	Production	Production
	'000 ha	'000 ton	'000 ha	'000 ton	'000 ha	'000 ton	'000 ton
Improved Rice	1.1	3.2	3.3	10.3	10.0	40.7	30.4
Traditional Rice	8.7	22.4	6.5	17.7	3.9	13.5	-4.2
Barley (on Paddy Land)	1.1	2.8	1.5	3.8	4.5	10.8	7.0
Barley (on Upland)	6.7	12.6	6.7	13.6	5.5	13.2	-0.4
White Potato	0.7	8.6	0.7	9.3	0.7	10.2	0.9
Soybean	3.4	2.7	3.3	3.2	1.3	1.5	-1.7
Tobacco	0.8	1.6	0.8	1.6	0.7	1.5	-0.1
Red Pepper	2.1	1.7	2.1	2.0	1.9	2.1	0.1
Sesame	3.0	1.5	3.0	1.8	1.0	0.7	-1.1
Chinese Cabbage	1.7	26.5	1.8	30.9	2.0	37.7	6.8
Sweet Potato	1.1	19.0	1.1	20.2	1.1	22.4	2.2
Cropped Area	30.4		31.0		32.7		
Land Area	21.7		21.7		21.7		
Cropping Intensity (%)	141		143		151		

ANNEX 15
Table 6

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Agricultural Data : Area 2 (8,600 ha)

	Imp. Rice	Trad. Rice	Common Barley	White Potato	Soy-bean	To-bacco	Red Pepper	Sesame	Chinese Cabbage	Sweet Potato
Present										
Yield (t/ha)	3.1	2.7	2.0	12.0	0.8	2.0	0.8	0.5	14.0	17.0
Seed Reqirement (kg/ha)	43.0	48.0	90.0	1,140.0	43.0	0.5	0.6	5.0	0.6	200.0
Fertilizer Requirement (kg/ha)										
Nitrogen	140.0	120.0	110.0	110.0	10.0	90.0	160.0	40.0	180.0	45.0
Phosphate	75.0	55.0	50.0	70.0	20.0	110.0	70.0	30.0	100.0	35.0
Potash	55.0	35.0	50.0	70.0	10.0	120.0	70.0	20.0	110.0	25.0
Pesticide (kg/ha)	14.5	9.0	2.0	4.0	0.0	10.0	12.0	3.0	20.0	0.0
Labor (man-days/ha)	115.0	110.0	110.0	120.0	90.0	235.0	232.0	100.0	135.0	143.0
Animal Draft (animal days/ha)	10.0	9.0	8.0	7.0	6.0	9.0	9.0	8.0	10.0	10.0
Future Without Project										
Yield (t/ha)	3.3	2.8	2.2	14.0	1.0	2.0	1.0	0.6	15.0	20.0
Seed Requirement (kg/ha)	43.0	48.0	90.0	1,140.0	43.0	0.5	0.6	5.0	0.6	200.0
Fertilizer Requirement (kg/ha)										
Nitrogen	140.0	122.0	115.0	115.0	15.0	90.0	170.0	45.0	185.0	60.0
Phosphate	75.0	60.0	50.0	70.0	30.0	110.0	80.0	35.0	110.0	40.0
Potash	55.0	40.0	50.0	80.0	15.0	120.0	75.0	25.0	115.0	30.0
Pesticide (kg/ha)	14.5	9.0	2.0	4.0	0.0	11.0	14.0	4.0	22.0	0.0
Labor (man-days/ha)	120.0	115.0	112.0	130.0	92.0	235.0	237.0	105.0	140.0	143.0
Animal Draft (animal days/ha)	10.0	9.0	8.0	7.0	6.0	9.0	9.0	8.0	10.0	10.0
Future With Project										
Yield (t/ha)	4.0	3.3	2.5	16.0	1.2	2.0	1.2	0.7	17.0	21.0
Seed Requirement (kg/ha)	43.0	48.0	90.0	1,140.0	43.0	0.5	0.6	5.0	0.6	200.0
Fertilizer Requirement (kg/ha)										
Nitrogen	150.0	128.0	120.0	125.0	25.0	90.0	180.0	50.0	190.0	65.0
Phosphate	80.0	65.0	60.0	70.0	60.0	110.0	85.0	35.0	120.0	40.0
Potash	60.0	45.0	60.0	80.0	20.0	120.0	80.0	25.0	125.0	30.0
Pesticide (kg/ha)	14.5	9.0	3.0	8.0	2.0	14.0	17.0	6.0	25.0	0.0
Labor (man-days/ha)	130.0	126.0	122.0	140.0	95.0	235.0	239.0	110.0	150.0	143.0
Animal Draft (animal days/ha)	10.0	9.0	8.0	7.0	6.0	9.0	9.0	8.0	10.0	10.0

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RURAL INFRASTRUCTURE PROJECT

Cropping Pattern, Yield and Production, Upland Reclaimed Area (4,500 ha)

Crop	Future Without Project[1]				Future with Project (w/out apples)				Future with Project (with apples)			
	Cropping Pattern %	'000 ha	Yield ton/ha	Production '000 tons	Cropping Pattern %	'000 ha	Yield[2] ton/ha	Production '000 tons	Cropping Pattern %	'000 ha	Yield[2] ton/ha	Production '000 tons
Forest	100	4.5	2.5	11.2	0	0.0	2.5	0.0	0	0.0	2.5	0.0
Apples	0	0.0		0.0	0	0.0	25.0	0.0	20	0.9	25.0	22.5
Pasture	0	0.0		0.0	20	0.9	22.5	20.2	9	0.4	22.5	10.1
Common Barley	0	0.0		0.0	45	2.0	2.4	4.9	40	1.8	2.4	4.3
Naked Barley	0	0.0		0.0	25	1.1	2.4	2.7	20	0.9	2.4	2.2
White Potato	0	0.0		0.0	8	0.4	16.0	5.8	9	0.4	16.0	5.8
Sweet Potato	0	0.0		0.0	15	0.7	18.0	12.1	15	0.7	18.0	12.1
Tobacco	0	0.0		0.0	4	0.2	2.0	0.4	4	0.2	2.0	0.4
Red Pepper	0	0.0		0.0	10	0.4	1.2	0.5	9	0.4	1.2	0.5
Chinese Cabbage	0	0.0		0.0	8	0.4	17.0	6.1	9	0.4	17.0	6.1
Soybean	0	0.0		0.0	25	1.1	1.2	1.3	20	0.9	1.2	1.1
Sesame	0	0.0		0.0	10	0.4	0.7	0.3	5	0.2	0.7	0.2
Total:		4.5		11.2		7.6		54.3		7.2		65.3
Cropping Intensity	100				170				160			

1/ Also represents present conditions.
2/ Barley yields are on a polished basis.

ANNEX 15
Table 8

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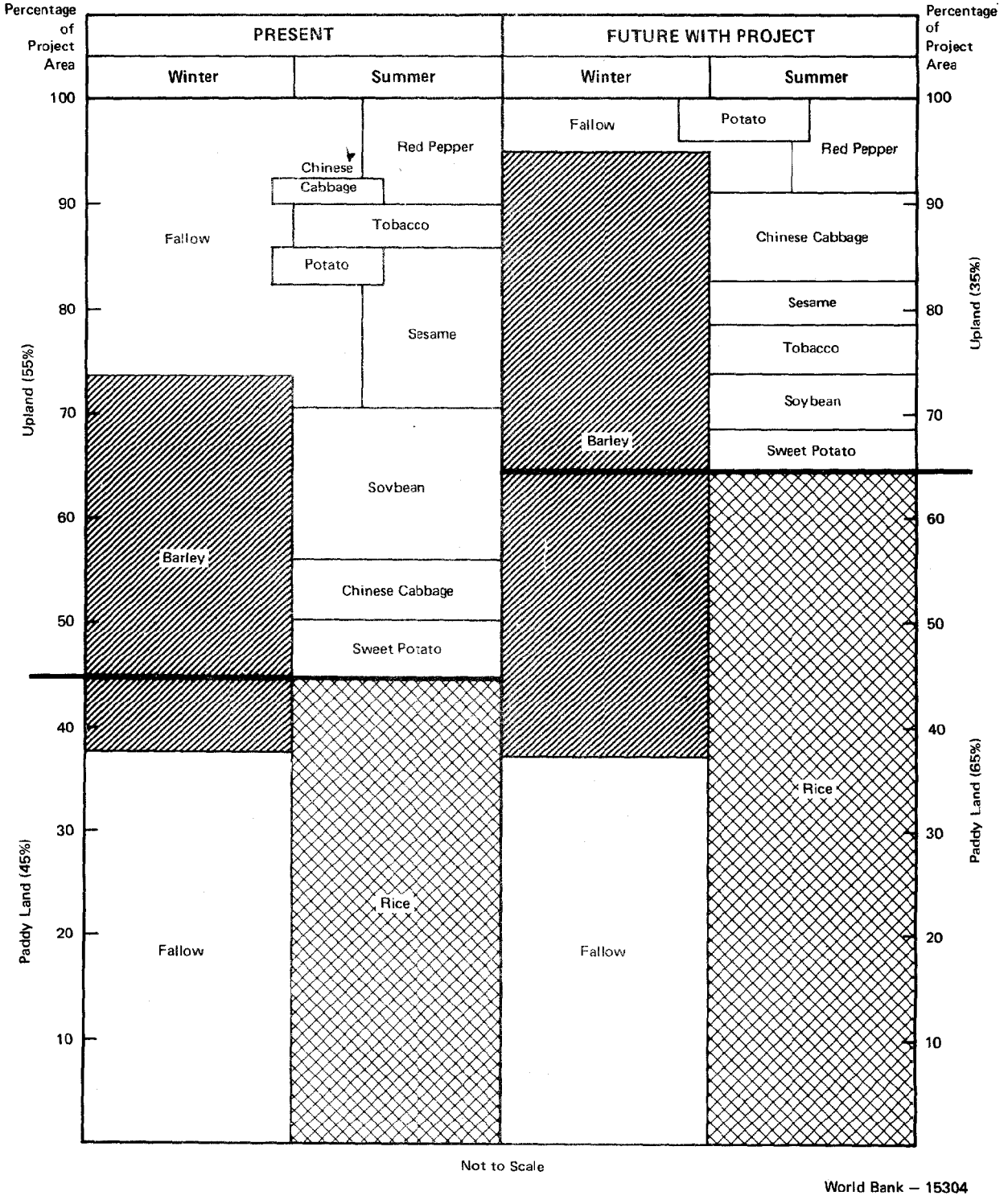
RURAL INFRASTRUCTURE PROJECT
Schematic Diagram of Cropping Patterns
(Composite of Areas I, II and III)



KOREA

RURAL INFRASTRUCTURE PROJECT

Agricultural Supporting Services

1. To maximize production and project benefits, the agricultural supporting services need to be functioning well and to be coordinated in their activities. This can be expected in Korea, as the Ministry of Agriculture and Fisheries (MAF) supervises all agricultural services in the country. Each Provincial administration has an Agriculture Bureau that administers MAF functions in the Province. Nearly all functions found at the national level are also found at the Provincial level and communication between them is good. The county administration provide a well-coordinated effort at that level. Except in the provision of motorcycles (para 7), the project would not provide for direct financial support of any of the agricultural services but the government has plans to increase its activities so as to properly support the project. The major agricultural supporting services are now discussed in turn.

Research and Extension

2. Both research and extension are more advanced in Korea than in most developing countries. Research and extension are discussed together since both are under the Office of Rural Development (ORD), a specialized agency of the MAF (Annex 3, Figure 1). ORD was established under the Rural Development Law of 1962 and has the following functions:

(a) Research and experimentation on agricultural techniques;

(b) Agricultural guidance and dissemination of agricultural techniques;

(c) Training of technical personnel and farmers; and

(d) Fostering of rural organizations for improving rural living standards.

ORD has a total staff of 8,250, comprising 317 at headquarters, 472 at the Provincial level, 2,357 at the 173 county offices, and 5,104 at the 1,473 district offices.

3. The national headquarters of ORD at Suweon, 40 km south of Seoul, consists of the following units:

Crop Improvement Station (breeding and agronomy of field crops);

Horticulture Research Institute (fruit and vegetables);

Agricultural Technical Research Institute (soil surveys, fertilizers, liming and pest control);

Rural Guidance Bureau (Extension);

Training Bureau (for extension workers); and

Farm Machinery Training and Irrigation Bureau (farm mechanization and water management).

4. Research on rice and barley is carried out at Suweon and also at field stations in Honan and Milyang. Research on rice, discussed in Annex 15, has concentrated on increasing yields and improving disease resistance. Research on barley is aimed at improving its resistance to cold weather and to developing earlier maturing varieties. Some improved barley varieties have recently been released. Extensive soybean research is conducted at Suweon. The Horticulture Station has developed a cold-resistant, early-maturing variety of a green pea, that can be planted early enough to be harvested before transplanting rice. Potato research is concentrated at the Alpine Station in Gang-weon Province. Breeding work there is aimed at resistance to virus disease and a new higher-yielding variety is being released. The horticulturalists are working on a pre-sprouting system for potatoes, using plastic covering to enable an early-Spring start with this crop to make better use of the available time before transplanting rice. The type of ORD research programs that would be directly beneficial to the minor irrigation and upland reclamation sub-project areas include: irrigation of upland crops; liming requirements; irrigation of barley and wheat; early-maturing wheat varieties; chemical weed control methods; and the use of mechanical equipment. Work is presently being done in some of these areas but further efforts would be desirable.

5. Each Province has an ORD branch which carries out local experimental trials, field demonstrations, multiplication of foundation seed and agricultural extension. The seeds function will soon be turned over to the newly-formed Office of Seeds Production and Distribution under the National Seeds Program just getting underway (para 13). Each county has an extension office staffed with about 15 extension officers. A typical county office would include specialists in the following areas: rice; upland crops; orchards; vegetables; mulberry/sericulture; livestock; soils and fertilizers; plant protection; farm management; agricultural engineering; household improvement; community development; 4-H Clubs; training and extension materials, and administration.

6. Each district extension office has a staff of four or five extension workers. They spend the summer months in the field working with the farmers and conduct meetings during the winter. The available pamphlets and illustrative materials for use by the farmers are adequate at present but will require revision and expansion to cover more subjects in the future. The

number of farm families covered by each extension worker varies from area to area but averages about 350 to 500 families (or about 500 ha of cultivated land), which is satisfactory. The existing extension system functions well, as illustrated by the rapid spread of Tongil rice and the technology associated with it (Annex 15). A recent ORD survey shows that farmers using Tongil rice have an average of 52 contacts per year with the district and county ORD staff, while farmers not using Tongil rice have an average of 38 contacts.

7. In districts containing minor irrigation sub-projects, the Government plans to add at least one additional extension worker. Motorcyles for these additional workers are included in the project. An additional rice specialist at the county level is also recommended in areas of increased activity. Young farmers (4-H) Clubs are found throughout Korea and they could perform a useful role in development projects, as part of the Saemaeul Movement, as well as faciliitating the introduction of new farming practices.

Agricultural Credit

8. The Government-sponsored cooperative system, the National Agricultural Cooperative Federation (NACF), is the main source of institutional credit. Interest rates for NACF credit range from 3.5% for long-term irrigation facility loans (Annex 14) to 15.5% for certain kinds of medium-term production and investment loans. However, the largest volume of loans is at 9%. These rates may be compared with Korean Development Bank industrial loan rates of 7.5% to 16.5% or commercial bank rates which are mainly in the 6% to 15.5% range. Farmers get about half of their credit from non-institutional sources, at rates of 4% to 6% per month. The funds available to the cooperative system from the Government budget and from its own cash generation fall far short of meeting the demand at the terms offered, so rationing of available credit by NACF is necessary. There are no precise estimates of the aggregate credit needs of the project farmers but it appears that lack of credit has not greatly retarded growth in the use of fertilizers or pesticides generally in Korea and it is not expected to do so in the sub-project areas. It is estimated that farmers in the sub-project areas get about 50% of their production credit needs from NACF. NACF also sells fertilizers, pesticides and farm machinery and operates warehouses and processing plants.

Farmland Improvement Associations (FLIA's)

9. The FLIA's are self-supporting associations of farmers formed under the Rural Modernization Promotion Law of 1970, though predecessor organizations date back to 1908. In 1974 there were 127 FLIA's in the country, covering 434,000 ha of irrigated land out of a national total of 1.2 million ha of paddy land. FLIA's have been established in all counties of Korea with significant agricultural production. Further details on their organization are given in Annex 3. Their main responsibilities are: operation and maintenance of irrigation and drainage facilities; agricultural improvement and land consolidation; assistance

to members in increasing production, through extension and training; and collection of repayments from the farmers for land improvement loans. FLIA's are an important element in the success of agriculture in areas where the introduction of irrigation or land consolidation has been accomplished. They hire their own extension workers to assist their members, primarily in rice production. These extension workers are well qualified and are recruited mostly from ORD staff. They generally receive higher pay than in ORD.

Hung Nong Gae

10. Hung Nong Gae ("Farmers' Action Groups") are water user groups, which may be constituent units of a FLIA, or may operate small irrigation systems outside the jurisdiction of a FLIA. In the latter case, the Hung Nong Gae is established by ADC to manage a newly established small system and its chief is appointed by ADC, on the recommendation of the district chief or county ORD office. Each Hung Nong Gae has about 100 members and is responsible for about 50 ha of irrigated land. As irrigation develops in a county, the Hung Nong Gae may form a new FLIA or merge with an existing one. In these cases, the Hung Nong Gae remain responsible for water distribution at the local level and act as a point of contact for the extension workers. They are also involved in small-scale improvement works, collection of water charges, hiring out of farm machinery and yield surveys.

Seed Production and Distribution

11. Present System - The Agricultural Production Bureau of the MAF is presently responsible for the planning and implementation of agricultural development programs, including the national field crop and potato seeds program. Seed varieties to be multiplied and distributed are determined by the Provincial governments. ORD multiplies the breeder and foundation seeds of these varieties and provides foundation seeds to the Provincial ORD seed farms. In the next stage, registered seed produced on the ORD seed farms, is distributed by each Provincial government to its selected seed growers located in most villages for reproduction as "certified" seed. The seed growers distribute this seed to village farmers under an ad hoc system and receive varying incentive payments from the Provincial government for their seed production and distribution operations.

12. Overall policy direction of the seeds industry is the responsibility of the MAF, advised by the National Seeds Council, which consists of the Vice-Minister of Agriculture as a chairman and representatives of MAF, ORD, the National Agricultural Products Inspection Organization and the Universities. The council has not had as much influence on the national seeds policy as originally intended. The Provincial governments and the seeds industry are not represented on the council, which has not had a role in guiding minimum regulatory standards and procedures nor been concerned with the effect of crop improvement research on the seeds industry. The National Agricultural Products Inspection Organizations has had only a limited role in seeds inspection, due to lack of equipment and staff and the reluctance

of the Provincial Governments to use its services. As a result of these problems, non-recommended varieties with relatively poor performance continue to be multiplied and distributed by the Provincial Governments, without adequate control of seed quality. Some of the seeds produced have been consumed as food rather than used for crop production. Seed production incentive payments and staff operations cost the government over US$1.0 million per year. In spite of the above shortcomings, shortages of seed have not been a constraint to crop production, though inadequate seed quality has reduced average yields below what they would otherwise have been.

13. Seeds Project - Recognizing the above problems, the Government has decided to reorganize its seeds multiplication and distribution system, with Bank assistance (Loan 942-KO). In March, 1975, a revised National Seed Law was passed, which sets out the steps and regulations necessary for a certified seed program to function. Under the revised law, the newly-formed Office for Seed Production and Distribution will operate the seed production, processing, and storage facilities and will distribute seeds. The project aims to establish a modern seeds industry in Korea, and to strengthen the agencies responsible for crop research and for seed certification. Facilities will be provided so as to be able to procure, process, store and distribute the following tonnages of certified seed per annum: paddy, 11,000; barley, 5,000; wheat, 1,000; soybeans, 500; and seed potato, 10,850. The project also includes a revolving fund for seed improvement, laboratory testing equipment, staff training and technical assistance. USAID is providing parallel financing to ORD for crop research. When completed in 1978, this project will provide the farmers of Korea with seeds of known purity, germination and freedom from weed seed in each of major crops. Thus, availability of adequate seeds would not be a constraint on the agricultural development of the Rural Infrastructure Project.

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RURAL INFRASTRUCTURE PROJECT

Project Evaluation - Minor Irrigation

1. The minor irrigation component would benefit directly 14,000 ha of farmland by improving irrigation on some 9,400 ha and by converting some 4,600 ha presently in upland crops to rice cultivation. Including the remaining upland areas of the sub-project beneficiaries, the total farm area affected by the project would be 21,700 ha or some 24,000 farms.

2. For the purposes of both economic and financial analysis, the total area farmed by the sub-project beneficiaries was considered, for the following reasons:

(a) The project involves a substantial amount of upland conversion. As a result of this conversion, the farmer will have to adjust his cropping pattern on the remaining upland. It was assumed that he will try to preserve the area of high-value crops and reduce accordingly the proportion of low-value crops; and

(b) Historical evidence shows that minor irrigation brings about a general improvement in cultivation practices which will thus positively affect crops other than rice. It was therefore assumed that other crops would benefit from the component.

3. For the purposes of the project, the country was subdivided into three regions. Main criteria for division were climatic conditions, resulting in different cropping patterns, intensities and yields. Details of the assumed cropping patterns, yields and production costs for the three regions are provided in Annex 15.

Farm Income Analysis

4. For the purposes of the analysis, three farm sizes were considered: 0.5 ha, 0.9 ha (the national average farm size) and 1.8 ha. Prices for rice, barley, tobacco, and soybeans used in this section are domestic farm-gate prices in early-1975 adjusted to January, 1976 levels by assuming a 20% increase during 1975. Prices for crops such as potatoes, red pepper, sesame and chinese cabbage (which are notably subject to price fluctuations) were derived by using a deflated average of prices from 1970 to early 1975, adjusted to January 1976 levels. Present and projected prices are shown in

Table 1. Production costs are based on the input levels shown in Annex 15. Water charges and production taxes are discussed in Annex 22. The calculation of farm income is presented in Tables 2, 3 and 4, was made before the increase in fertilizer prices in December 1975. Thus, net farm incomes, with or without the project, would be slightly lower than the amounts shown and discussed below.

5. From a financial standpoint, the minor irrigation component is judged to have sufficient incentives to attract the farmers' participation. A farmer with a 0.9 ha holding, the national average farm size, has at present a farm income of Won 540,000 (US$1,100). This is 12% lower than the national average farm income, which is Won 622,000 (US$1,280). As a result of the project, the average farmer's income would increase by 64% to Won 885,000 (US$1,820) at full development.

6. Small farmers, with holdings of 0.5 ha or less, would greatly benefit from the project. The present farm income of a farmer with a 0.5 ha holding is estimated at Won 340,000 (US$700). The national average farm income for a farm of this size is Won 389,000 (US$800). As a result of the project, the income of small farmers would increase 63% to Won 555,000 (US$1,140). This increase in crop income of the small farmer probably underestimates the total benefits of the project to him, as the small farmer will also be the main beneficiary of the additional demand for farm labor generated by the project (para 17).

Income Distribution Impact

7. There are no precise figures on the farm size distribution of the rural households affected by the project. Assuming a distribution similar to the national farm size distribution, the proportion of population living on a farm of 0.5 ha or less, is 33% or 11% of the land area. According to a recent Bank estimate, 25% of the total rural population are at or below the "minimum consumption level" or poverty line. The available evidence (para 6) suggests that the project area population, on average, have lower incomes than the national rural average. An approximate estimate would be that 35% of the beneficiaries of the component live below the level of absolute poverty and that 15% to 20% of the benefits of this component would accrue to this target group.

Economic Analysis

8. Prices - Shadow pricing has been used to evaluate the major inputs (fertilizer and labor) and internationally traded outputs (rice, barley, soybean and tobacco). It appears that price distortions are not severe for the other inputs and outputs of the component.

9. The farm-gate price of rice for the economic analysis is calculated as follows:

	US$/ton (milled basis)
Forecast 1985 world market price (in early 1976 constant dollars) /1	335
Ocean freight and insurance	35
Import price cif Incheon/Busan	370
Effective import price	370
Value of by-products (8%)	30
Farm-gate Price /2	400 (Won 225,000/ton) /3

/1 The commodity price forecast for Thai 5% broken rice fob Bangkok in 1985 (in terms of 1973 constant dollars) is US$240/ton. This price was adjusted to an early 1976 unit value by using a conversion factor equal to 140.3 (1973=100). Most of Korea's rice imports are of U.S. origin and are equivalent to or better than Thai 5% broken in quality.

/2 The value of port handling charges is taken as equal to the value of inland transport costs. The cost of milling has been assumed to be offset by the value of bran produced.

/3 Using shadow foreign exchange 560 won = US$1.

10. Since no world market price projection is available for barley intended for human consumption, polished barley was assumed to be worth 85% of the value of the wheat flour, based on observed trends. This ratio reflects the taste preference of Korean consumers for wheat flour. Prices for soybean, tobacco and fertilizer are world market prices, as supplied by the Bank's Economic Analysis and Projections Department. For the remaining crops, which are not traded internationally, recent average farm-gate prices were used, as for the farm budget analysis (para 4). All commodity prices were converted from an fob price at the port of export to a farm-gate basis by adding US$35, to represent the average value of insurance, shipping and inland transport to the major market centers minus the cost of transporting the farm produce to the market centers.

11. Foreign Exchange. Due to the existence of import taxes and export subsidies, the official exchange rate understates the value to the economy of the foreign exchange used in carrying out the project and earned by the incremental production of internationally traded commodities. According to studies by the Korea Development Institute, the effective exchange rate (the one that would prevail in the absence of any impediments to trade) is approximately 15% higher than the official exchange rate. Consequently, a shadow foreign exchange rate (Won 560 = US$1) was used to evaluate internationally traded commodities and the foreign exchange component of the inputs and construction costs.

12. Labor Analysis - The demand for labor in the rural areas of Korea is highly seasonal in character. During the crop season (April to October), there is no widespread unemployment. During the peak months (June and October), labor shortages may develop in some areas. As the rural labor force is relatively mobile, the labor market works fairly efficiently and it is appropriate to use the observed market wage rate for hired labor as a measure of the opportunity cost of all labor during the crop season. Thus labor has been evaluated at Won 1,800/man-day for April, May, July, August and September and Won 1,900/man-day for June and October. During the winter months, there is little wage employment. There is, however, some self-employment, notably the weaving of bags from rice straw. The net income from this activity is approximately Won 450/man-day and this value has been used to represent the opportunity cost of unskilled labor in the winter months, November to March.

13. Project Costs - To avoid the problem of projecting costs and benefits far into the future, an evaluation period of 35 years was used and it was conservatively assumed that the project facilities would have a salvage value of 25% of their original cost at the end of the evaluation period. The construction and recurrent costs of the minor irrigation component are given in Annexes 3 and 10. Construction costs were adjusted for the economic analysis. As the minor irrigation component is to be constructed by contract, it is not possible to determine precisely the income and sales taxes and import duties paid by the contractors and to exclude them from the project cost estimate. For economic analysis, an adjustment should be made for these transfer payments and, accordingly, all construction costs were reduced 10% on this account. A further adjustment was made for the opportunity cost of the unskilled labor used in construction. It was assumed that such labor accounts for 20% of the construction cost and that an annual average shadow wage rate of 75% would be appropriate for such labor, following the reasoning of para 12. Thus, construction costs have been reduced 5% on this account. Even though the project cost estimate does not provide for physical contingencies, for the reasons given in para 4.13, it would perhaps be incorrect to perform an economic analysis on this basis, which could put the project at an advantage, compared to alternative irrigation projects. Therefore, construction costs were increased 10% as a physical contingency allowance. The rather low figure of 10% is believed to be appropriate for these small-scale standardized works. Finally, an adjustment was made to reflect the effective cost of foreign exchange. The resulting construction cost for economic analysis is approximately equal to the financial cost.

14. The cost estimates used do not include any specific allowance for the farmers' own investment in on-farm development (para 4.15), as this is generally a small proportion of the total cost, highly variable between sub-projects and difficult to quantify. As the work would be spread over

several months and would be done at times when the farmer would otherwise be unemployed, the opportunity cost of this labor would be very small and has been neglected.

15. Rate of Return - The internal economic rate of return for the whole minor irrigation component was found to be 12.6% (Table 6). The rates of return for the three areas are shown below:

Area	Rate of Return (%)
I	11.9
II	13.4
III	12.4

The lower rate of return for Area I reflects the more rigorous climate and the more restricted opportunities for double cropping in that region.

16. Sensitivity Tests - The following tests were made to test the sensitivity of the rate of return to the more important assumptions made in deriving it:

Test	Economic Rate of Return (%)
Mean value	12.6
Cost overrun of 20%	10.8
Slow build-up of benefits - full development delayed to Year 8	11.8
Price of rice - 20% reduction	9.3

The rate of return is sensitive only to the price of rice but that removal of the premium for self-sufficiency does not reduce the rate of return below an acceptable level. In order to assess the impact of price fluctuations more precisely, a risk analysis was performed. It was assumed that the probability of the price of rice being close to the estimated value would be 40% and that the probability of its falling from 10% to 25% below the estimated value would be 60%. Under these assumptions, the expected value of the rate of return would be 11.3%, with a standard deviation of 2%. Under these assumptions, the risk of lower prices appears acceptable.

Employment Impact

17. The minor irrigation component would generate an incremental labor demand equivalent to 2,600 full-time jobs. On the smaller farms, the additional labor would be provided by the family members. Farms of 1.8 ha and above would require additional hired labor, however, and this is likely to be equivalent to about 700 full-time jobs.

KOREA

RURAL INFRASTRUCTURE PROJECT

Minor Irrigation : Prices of Inputs and Outputs
(Won '000/ton)

	Present		Future	
	Financial	Economic	Financial	Economic
Crops				
Improved Rice	266	266	266	225
Traditional Rice	266	266	266	225
Common Barley	145	131	145	131
White Potato	66	66	66	66
Soybean	182	153	182	185
Tobacco	630	784	630	784
Red Pepper	1,215	1,215	1,218	1,215
Sesame	720	720	720	720
Chinese Cabbage	38	38	38	38
Sweet Potato	53	53	53	53
Apples	145	145	145	145
Fertilizers (per nutrient ton)				
Nitrogen	168	350	168	198
Phosphate	140	355	140	173
Potash	54	68	54	55
Pesticides				
Pesticides	1,425	1,455	1,425	1,455
Seeds				
Improved Rice	180	180	180	180
Traditional Rice	180	180	180	180
Common Barley	100	100	100	100
White Potato	100	100	100	100
Soybean	200	200	200	200
Tobacco	20,000	20,000	20,000	20,000
Red Pepper	18,000	18,000	18,000	18,000
Sesame	720	720	720	720
Chinese Cabbage	23,500	23,500	23,500	23,500
Sweet Potato	55	55	55	55

KOREA

RURAL INFRASTRUCTURE PROJECT

Farm Income Statement for 0.5 ha Farm
(Won '000)

	YEAR						
	1	2	3	4	5	6	7-35
Crop Value	351	351	424	496	568	592	592
Water Charge	0	0	10	10	10	10	10
Tax	0	0	0	0	5	5	5
Debt Service	0	0	7	7	7	9	10
Farm Income	351	351	407	479	546	568	567
Hired Labor	0	0	0	0	0	0	0
Hired Animal	10	10	10	11	11	12	12
Net Income	341	341	397	468	535	556	555

KOREA

RURAL INFRASTRUCTURE PROJECT

Farm Income Statement for 0.9 ha Farm
(Won '000)

	YEAR						
	1	2	3	4	5	6	7-35
Crop Value	558	558	681	803	925	966	966
Water Charge	0	0	18	18	18	18	18
Tax	1	1	2	6	20	24	24
Debt Service	0	0	13	13	13	17	19
Farm Income	557	557	648	766	874	907	905
Hired Labor	0	0	0	0	0	0	0
Hired Animal	17	17	18	19	20	20	20
Net Income	540	540	630	747	854	887	885

KOREA

RURAL INFRASTRUCTURE PROJECT

Farm Income Statement for 1.8 ha Farm
(Won '000)

	YEAR						
	1	2	3	4	5	6	7-35
Crop Value	969	969	1,189	1,409	1,629	1,703	1,703
Water Charge	0	0	37	37	37	37	37
Tax	17	17	20	29	53	61	61
Debt Service	0	0	25	25	25	32	39
Farm Income	952	952	1,107	1,318	1,514	1,573	1,566
Hired Labor	34	34	40	46	53	55	55
Hired Animal	0	0	0	0	0	0	0
Net Income	918	918	1,067	1,272	1,461	1,518	1,511

KOREA

RURAL INFRASTRUCTURE PROJECT

Minor Irrigation - Economic Analysis (Total Project)

Year	Construction Cost	Operation and Maintenance Cost	Benefits[1/]
	----------Won million----------		
1	12,600	0	0
2	12,600	0	0
3	0	420	665
4	0	420	1,330
5	0	420	2,565
6	0	420	4,560
7-34	0	420	4,845
35	-6,100	420	4,645

Economic Rate of Return = 12.6%.

1/ Benefits = Incremental value of production minus inputs minus economic cost of labor.

KOREA

RURAL INFRASTRUCTURE PROJECT

Project Evaluation - Upland Reclamation

1. The upland reclamation component would benefit an area of 4,500 ha, by converting previously unproductive sloping land to cultivable land. After conversion, these lands would grow a variety of upland crops, including barley, soybeans, high-value cash crops and fruits. For the purposes of evaluation, it was assumed that the upland reclamation sub-projects would not affect the cropping pattern of the present farmland. Thus the evaluation was performed only for the converted land.

2. Preliminary studies showed that the economic viability of upland reclamation might be sensitive to the assumed cropping pattern, in particular, to whether orchards are included. Orchards affect the benefit estimate in two ways:

(a) At full development, orchards are very profitable and have a much higher value added than any other crop; but

(b) Orchards have a long build-up period, during which they have negative returns.

Therefore, two alternative cropping patterns were considered: with and without apple orchards. Cropping patterns, crop budgets, and production estimates are given in Annex 15.

3. The price assumptions used (including wage rates), both for farm income estimates and economic analysis are identical to those used for the minor irrigation component (Annex 17). For the price of apples, the average 1970-1975 price, adjusted to January, 1976 levels, was used.

Farm Income

4. Table 1 shows that, as a result of the project, an additional amount of upland of 1 ha will generate an additional net income of:

(a) Won 931,000 (US$1,920) at full development for the cropping pattern with apples; or

(b) Won 542,000 (US$1,118) at full development, for the cropping pattern without apples.

While the additional farm income is considerably higher in the case of cropping patterns with apples, there will also be four years of negative cash

flow in this case. This implies that medium-term credit should be made available to farmers who intend to grow apples.

Economic Analysis

5. An economic analysis was performed for each cropping pattern (Table 2). The internal economic rate of return was found to be:

(a) 21.2% in the case of the cropping pattern including apples;

(b) 20.8% in the case of the cropping pattern without apples.

These results suggest that both cropping patterns are economically viable. The choice between them should consequently be made on a basis of technical and financial (availability of credit) considerations.

6. Sensitivity tests show that the economic rate of return is not affected seriously by foreseeable changes in costs and benefits. For the cropping pattern with apples, a 20% decrease in benefits, would bring the rate of return to 18.9%. For the cropping pattern without apples, a similar decrease in benefits would yield a rate of return of 17.4%.

Employment Impact

7. The upland reclamation project would generate an incremental farm labor demand of:

(a) 1,258 man-years, for the cropping pattern including apples; and

(b) 996 man-years, for the cropping pattern without apples.

It is estimated that the bulk of the additional labor would have to come from hired workers and this is reflected in the farm income projections.

KOREA

RURAL INFRASTRUCTURE PROJECT

Upland Reclamation - Partial Income Statement for 1 ha Farm
Case A (with Apple Orchards)

	YEAR														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Crop Value	15	15	-100	15	66	130	336	464	824	1,056	1,184	1,300	1,300	1,300	1,300
Tax	0	0	0	1	4	8	20	28	49	63	71	78	78	78	78
Debt Service	0	0	26	26	26	74	74	74	74	74	0	0	0	0	0
Farm Income	15	15	-126	-12	36	48	262	362	701	919	1,113	1,222	1,222	1,222	1,222
Hired Labor	0	0	0	0	24	10	68	95	172	221	248	273	273	273	273
Hired Animal	0	0	0	0	1	1	4	6	11	14	16	18	18	18	18
Net Income	15	15	-126	-12	11	37	189	261	518	684	849	931	931	931	931

Case B (without Apple Orchards)

Crop Value	15	15	244	473	587	664	740	778	778	778	778	778	778	778	778
Tax	0	0	15	28	35	40	44	47	47	47	47	47	47	47	47
Debt Service	0	0	26	26	26	74	74	74	74	74	0	0	0	0	0
Farm Income	15	15	203	447	561	590	666	657	657	657	731	731	731	731	731
Hired Labor	0	0	50	101	126	143	160	168	168	168	168	168	168	168	168
Hired Animal	0	0	6	12	15	17	20	21	21	21	21	21	21	21	21
Net Income	15	15	147	333	419	428	486	468	468	468	542	542	542	542	542

ANNEX 1A
Table 1

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RURAL INFRASTRUCTURE PROJECT

Upland Reclamation - Economic Analysis

Year	Cropping Pattern A (with apples)		Cropping Pattern B (without apples)	
	Construction Costs	Benefits	Construction Costs	Benefits
	---Won million---			
1	2,200	0	2,200	0
2	2,200	0	2,200	0
3	0	-300	0	400
4	0	0	0	800
5	0	100	0	1,000
6	0	300	0	1,100
7	0	800	0	1,300
8	0	1,100	0	1,300
9	0	2,000	0	1,300
10	0	2,600	0	1,300
11	0	2,900	0	1,300
12-35	0	3,200	0	1,300
Economic rate of return:		21.2		20.8

KOREA

RURAL INFRASTRUCTURE PROJECT

Project Evaluation - Fuelwood

1. The principal benefits of the fuelwood component would be:

(a) an increase in farmers' incomes, as a reduction in the use of agricultural residues for heating purposes would allow them to be used for composting and other productive purposes;

(b) conservation of Korea's scarce mineral energy resources (principally coal);

(c) creation of permanent timber-producing forests, as a secondary purpose of the fuelwood component;

(d) a reduction in soil erosion and flood damages; and

(e) institution building at the village level, leading to increased self-reliance.

An attempt is made to qualify benefits (a) and (b). Benefits (d) and (e) will be discussed only in qualitative terms. As discussed in Annex 5, many of the fuelwood plantations would have an admixture of timber species. As the returns from timber production are known to be at least as attractive as those from fuelwood, only the latter type of plantation has been evaluated. This should provide a minimum estimate of the rate of return of the fuelwood component.

Valuation of Fuelwood

2. The precise estimation of the benefits of the fuelwood component is difficult, since at present (given the scarcity of fuelwood), the latter is not traded and therefore there are no reliable data on its market value. Consequently, it was necessary to value the fuelwood at its opportunity cost, that is, in terms of the resources that it would replace. At present, there is a severe shortage of fuelwood. The Office of Forestry estimates that, in 1974, fuelwood satisfied only about half of the domestic fuel requirements in rural areas. An average rural household required 4.2 tons of fuelwood for heating purposes and was able to obtain only 2.2 tons. The balance of its requirement was supplied by agricultural residues and coal. Therefore, additional fuelwood production would be used to replace agricultural residues and coal, the value of which could be used to estimate the opportunity cost of fuelwood.

3. Field observations suggest that 80% of the additional fuelwood production would replace agricultural residues and 20% would replace coal. The calorific value of agricultural residues is about 90% that of fuelwood, while that of Korean coal (which is very low grade) is about equal to fuelwood. Thus 1 kg of fuelwood would replace 0.9 kg of agricultural residues plus 0.2 kg of coal. The price of both fuels, delivered to the village, is about Won 12/kg (in early-1976 prices) and thus the opportunity cost of fuelwood is Won 13,000 (US$27)/ton.

Project Benefits

4. Assuming plantation establishment in Year 1, full yield would be reached in Year 8 and would equal 5.0 ton/ha for a typical fuelwood stand (Annex 5). Yields would build up as follows:

Year	Yield (ton/ha)	% of Full Development
1-3	0	0
4	0.5	10
5	1.0	20
6	2.0	40
7	4.0	80
8-20	5.0	100

It is assumed that the plantation would be clear-cut in Year 21, yielding 125 ton/ha of fuelwood. During Years 1 to 3, there would be a certain amount of grass and weeds produced but it is assumed that the economic value of this would be merely equal to the opportunity cost of labor used in collecting it.

Project Costs

5. The cost per ha of plantation establishment is given in Annex 10, Table 4. Materials, transport, supervision and overhead are evaluated at their financial cost and total Won 51,200/ha. Planting takes place in March or April, which is on the borderline between the crop season and the off-season (Annex 17). Village volunteer labor has therefore been valued at Won 1,150/man-day, which is a weighted average of the main-season (Won 1,800) and off-season (Won 450) opportunity costs of labor. An average of 61 man-days/ha of unskilled labor would be required. The total cost of establishment is therefore Won 116,000 (US$240)/ha.

6. Recurrent costs include: weeding; management; and harvesting. The cost of weeding would be offset by the fuelwood value of the grass collected (para 4). Management by Office of Forestry and Union of Village Forestry Associations personnel has been set at 0.1 man-day/ha/yr and valued at Won 2,500/man-day. Other supervision costs (fire prevention, insect control, and so on) would total about Won 2,200/ha/yr. Harvesting would take place in the off-season months and village labor is therefore valued at Won 450/man-day. It is assumed that one man can harvest and transport (by A-frame) 120 kg/day. Thus the harvesting cost would be Won 3,750 (US$7.75)/ton.

Project Evaluation

7. The cost and benefit streams are shown in Table 1. The rate of return is estimated to be 19%, which indicates that the investment is attractive. The rate of return is not unduly sensitive to any of the assumptions made in deriving it.

8. Besides the direct benefits of the fuelwood component, which are evaluated above, there are several indirect and intangible benefits, for which few data are available. Concentration of fuelwood production close to the village would ease the pressure on the natural "forest" around the village as a source of fuelwood and would enhance its potential for commercial timber production, or for conversion to cropland or pasture. The non-removal of forest litter in such areas would retard erosion and reduce flood peaks.

9. A major intangible benefit of the fuelwood component would be its contribution to the strengthening of village institutions. That is one reason why fuelwood projects are often among the first to be undertaken by "Basic" villages under the Saemaeul Movement. Fuelwood plantations, while technologically simple, give a very tangible demonstration to the villagers of the benefits of cooperative action.

KOREA

RURAL INFRASTRUCTURE PROJECT

Economic Analysis of Fuelwood Plantation
(US$/ha)

Year	1	2	3	4	5	6	7	8	. . . .	20	21
COSTS											
Establishment	240	-	-	-	-	-	-				
Supervision	-	5.2	5.2	5.2	5.2	5.2	5.2	5.2	. . . .	5.2	
Harvesting	-	-	-	3.9	7.7	15.4	30.8	38.7	. . . .	38.7	1,932
Total Costs	240	5.2	5.2	9.1	12.9	20.6	36.0	43.9	. . . .	43.9	
BENEFITS											
Fuelwood		-	-	13.4	26.8	53.6	107.2	134	. . . .	134	3,350
NET BENEFITS	-240	-5.2	-5.2	4.3	13.9	33.0	71.2	90.1	. . . .	90.1	1,418

Economic Rate of Return = 18.6%

ANNEX 19
Table 1

KOREA

RURAL INFRASTRUCTURE PROJECT

Project Evaluation - Roads and Bridges

1. The main benefits of the proposed rural roads component would be:

(a) time savings and a reduction in transportation costs, which arise from the use of trucks rather than mancarried A-frames (chigae) to transport agricultural inputs and outputs; and

(b) increased farm income as a result of a shift from low-value crops, such as pulses, to high-value perishable crops, such as vegetables and fruits.

This Annex attempts to quantify those benefits. The benefits of bridges cannot be so readily quantified, as a new bridge may affect the traffic pattern in a wide area. However, if the area served is known and the cost of the bridge and the time savings by its use converted to an equivalent length of road, the results shown below could be used also for bridges.

2. The importance of the benefits related to agricultural production is highlighted by a number of empirical studies. For example, a survey of 17 villages by C.H. Kim 1/ on the influence of roads on farm enterprises showed that, as road conditions improved (from footpath and cart track to truck and bus roads), farmers reduced the percentage of their land devoted to cereals and potatoes in favor of fruits and vegetables. Thus, the area under cultivation for vegetables was 123% greater in a village served by a truck road than in a village served by a footpath, and 65% greater than in a village served by a cart track. Furthermore, according to the same study, a large proportion of farmers intended to switch to production of higher-value crops if access roads were built and/or improved - 80% of the farmers in footpath villages, and 75% of those in the cart track villages expressed this intention. In another study, K.W. Lee argued that improved roads resulted in a higher Gross Value of Product (GVP) for the farmers. 2/ According to this

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1/ Kim, Chung Ho, "Influence of Road Class and Means of Transportation on Farm Enterprise Distribution - Hwasung Gun, Kyonggi Do," MAF, Korea, September, 1970.

2/ Lee, Kyung Won, "Some Effects of Roads on Agricultural Production and Rural Life," Dept. of Agricultural Economics, Seoul National University, May 1969.

study, the average GVP/ha in a village with good road access was 75% higher than the GVP/ha in a village without a good road.

3. Field observation and interviews tend to confirm those findings. Villagers place a very high priority on roads among their development projects. In some cases, road construction has been undertaken by the villagers themselves without any prior consultation with the authorities. Farmers invariably mention better access to the market and substitution of trucks for A-frames as the main benefits of an access road. They also expressed willingness to switch to higher-value perishable crops, should transportation to the market be improved.

4. The trucking industry in Korea is dynamic, versatile and competitive. It is reasonable to assume that it would respond quickly to new opportunities and serve villages with a newly built road. This appears to have been the case for rural roads already completed, provided that such roads were longer than 2 km.

5. An attempt was made to estimate the benefits in time savings and increased income accruing from a village road. In order to make the evaluation applicable to the evaluation of specific sub-projects, benefits were standardized for a unit of cultivated land (para 7).

Reduction in Transportation Costs

6. (a) Without the project, the agricultural inputs and outputs would be transported on an A-frame. A man can carry an average of 60 kg in an A-frame at a speed of 3.5 km/hr (3 km/hr in winter). Therefore, to transport 1 ton-km by A-frame, 4.75 man-hours (5.5 man-hours in the winter) are required. At present, no monetary value is attached to this mode of transportation, which is usually done by the farmer and members of his household. It is therefore necessary to estimate the opportunity cost of the farmer's time. This cost would differ according to whether the transportation takes place during the farming season or the off season. During the farming season, the farmer's time is valued at the average market wage rate of Won 1,800/day (Won 200/hr) (Annex 17). During the off season, the farmer's time is valued at the shadow wage rate of Won 450/day (Won 64/hr). 1/ Thus, the cost of transportation of 1 ton-km would be Won 950 in the farming season and Won 355 in the off season.

(b) With the project, agricultural inputs and outputs would be carried by a truck, at the rate of Won 125/ton-km, based on field observation.

1/ Assuming a seven hour workday during the off-season.

(c) The net cost savings from substituting truck for A-frame would be:

- in the farming season, Won 825 (US$1.70)/ton-km;

- in the off season, Won 230 (US$0.47)/ton-km.

7. In order to estimate the reduction in transportation costs resulting from time savings, it is necessary to compute the tonnage transported from the market to the farm and vice versa. This was done on the basis of a unit of cultivated land comprising 1 ha of paddy plus 0.83 ha of upland. 1/ The marketable surplus was estimated by subtracting from the total production the domestic consumption (Table 1).

8. The total tonnage to be transported was estimated at 7.3 ton per 1.83 ha unit of land (1.2 ton of inputs; 6.1 ton of outputs). It was assumed that 60% of this tonnage would be transported in the farming season and 40% during the off season. Field observations suggest that only a small part of output is stored, apart from that needed for domestic consumption, as farmers are usually hard-pressed for cash and prices, being controlled by the government, do not show a pronounced seasonal variation. The transportation cost savings per km were estimated at Won 4,290 (US$8.84) per unit of cultivated land. These savings per land unit are equivalent to 20.8 man-hours (or 2.3 man-days) during the farming season, and 16.2 man-hours (2.3 man-days) in the off season.

9. Field observations suggest that a significant portion of the land, in particular of the paddy land, lies between the village and an existing provincial or county road. This is more true for the shorter roads up to 3 km. Consequently, it was decided to adjust an average length of a round trip for agricultural input/output transportation. For the roads up to 3 km, the effective length was assumed at 0.75 of, and for the longer roads, at 0.9 of, the actual road length.

Increases in Farm Income and Production

10. Better and quicker access to the markets both for inputs and outputs and greater availability of labor freed from A-frame transport servitude, are likely to result in a changing cultivation pattern. In particular, a farmer is likely to increase the relative share of high-value crops, requiring higher labor inputs, better access to marketing services and a quicker delivery to the market. These are primarily vegetables (chinese cabbage,

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1/ Data supplied by the Ministry of Home Affairs provides information only on the amount of paddy land affected by the road. The associated amount of upland was derived by applying national average: 1.2 ha of paddy for 1 ha of upland.

raddish, tomatoes and so on) and fruits (apples, pears, peaches, or watermelons). The shift from low to higher-value crops was estimated on the evidence of farmers' responses to road construction in the past. For the purposes of evaluation, data published by C.H. Kim were used. It was assumed that, as a result of road construction, the percentage of area devoted to vegetables would increase by 65% and the area devoted to fruits by 35%. These increases are lower than those observed by Kim as the subproject villages probably have a lower comparative advantage than those connected earlier. Two additional assumptions were made:

(a) The shift would occur rather quickly. For vegetables, the full increase would be achieved in the second year after construction and for the fruits, in the seventh year (due to the longer period before fruit trees come into full bearing); and

(b) the increase in area planted to vegetables would be at the expense of pulses. Fruits, which are grown on steeper slopes, would be planted on previously uncultivated areas.

11. On the basis of a cropping pattern similar to that assumed for the minor irrigation component (Annex 15), a farmer would increase the area of vegetables from 0.09 to 0.15 ha and, accordingly, reduce the area of pulses from 0.25 ha to 0.19 ha, per land unit. Upon the completion of the shift, the increase in the net value of production would be US$10.2/land unit. 1/ The net value of production is reduced to US$8.2/land unit, when an adjustment is made for the transport cost of the additional tonnage produced. 2/ The benefit buildup rate was assumed to be 50% in Year 1 and 100% in Year 2.

12. The area planted to fruit would increase from 0.08 ha to 0.1 ha. Additional costs incurred would equal on the average US$40 for this 0.02 ha increase. 3/ The additional income from the sale of fruits at the full bearing would equal US$100 (after deducting additional transportation costs). The following buildup rate was assumed:

1/ Values added per crop are based on data presented in Annexes 15 and 17. The following NVP's were used: US$438/ha for vegetables; US$268/ha for pulses. As vegetables are more labor intensive than pulses, the NVP includes the incremental cost of farm labor (3 man-days) valued at the market wage rate (US$3.71).

2/ Assuming an incremental production of 0.78 ton and an average round trip length of 10 km, the additional transportation cost would be US$2.

3/ Labor = 6.2 mandays x US$3.71 = US$23. Other inputs = US$17. Data is derived from Annexes 15 and 18.

Year	% of benefits
1	0
2	0
3	12.5
4	25
5	62.5
6	87.5
7	100

The corresponding increases in net value of production would be:

Year	Net value added (US$)
1	- 40
2	- 40
3	- 27.5
4	- 15
5	+ 22.5
6	+ 47.5
7-20	+ 60

Evaluation of Costs

13. The following assumptions on costs were made:

(a) Construction Costs. Monetary outlays (for materials, skilled labor, and supervision) were estimated at US$5,460/km (Annex 10). The unskilled labor, which would be supplied by the villagers, was valued at the shadow wage rate for off-season work of US$0.93 (Won 450)/day for a requirement of 1,458 man-days/km. Thus the unskilled labor cost is US$1,356/km. Adding 15% of the monetary cost for the donated rights-of-way and miscellaneous costs, we have an estimated economic cost of road construction of US$7,575/km.

(b) Maintenance Costs. Maintenance requirements were estimated at 180 man-days/km/yr. Of this, 120 man-days would be required for gravelling and repair work to be done in the farming season (July and August, following the rainy season) and 60 man-days would be for routine maintenance in the off season. Maintenance would be done manually by the villagers. Using the shadow wage rates of para 6, the imputed costs of maintenance were therefore estimated as US$500/km/yr.

(c) Salvage Value. The salvage value after 20 years was assumed to be 50% of the original construction cost.

14. The economic analysis of rural roads was carried out for road lengths from 2 to 6 km, and for different sizes of agricultural areas affected - from 50 to 200 ha of paddy (or from 91.5 ha to 366 ha of cultivated land). The lengths of roads considered were estimated to be sufficiently long to be worthwhile for trucks to visit the village yet not so long that they would be beyond the capacity of a village to construct. The results of the analysis are shown in Table 2 and Figure 1. The rate of return varied from 1.6% for a 6 km road serving 50 ha to 21.8% for a 2 km road serving 200 ha.

15. The above evaluation procedure can be used for the selection of economically feasible sub-projects. For each sub-project, the length of the road and the agricultural area served are known. Assuming a certain minimum level of economic rate of return, the economic feasibility of the given sub-project can be rapidly ascertained. For example, assuming 8% as the cutoff rate of return, one can see that, for a 2 km road to be feasible, it should serve at least 55 ha of paddy; a 3 km road, at least 75 ha; a 4 km road, at least 80 ha; a 5 km road, at least 85 ha; and a 6 km road, at least 95 ha. Thus, given a specified level of the minimum economic rate of return and information about the agricultural area served, one can determine approximately if a proposed sub-project would be economically feasible and should be undertaken. In actuality, several other features, such as the development potential of the village and the actual construction cost of the sub-project, should also be taken into account (para 18). As will be shown below, non-agricultural benefits may also be significant and thus a fairly low cutoff rate of return has been used in the above discussion.

Additional Benefits

16. The above estimates provide only a partial picture of the benefits of the road component. Other benefits that are likely to accrue from better access are:

(a) A general increase in agricultural output. This would result from better farming technology, more intensive use of fertilizers and other inputs, more frequent contacts with extension agents, better exposure to regional markets and the adoption of innovations generated in the outside world;

(b) Better access to health and educational facilities. In the case of serious illness, the absence of an all-season road may result in a loss of life. Similarly, the absence of regular transportation may force teenage children to live in the towns, where

the High Schools are located, which may be 15 to 20 km from the village. This generates additional costs for board and room, may loosen family ties, and may preclude High School education for some students; and

(c) Better access to alternative employment opportunities. When there is no public transportation between villages and nearby towns, the search for off-farm employment becomes a choice between staying in the village working on a farm, or migrating to the town. A road that would bring a bus to the village would make commuting to work in a nearby town possible. On the basis of field interviews in Gang-weon Province, it appears that, in some areas, between 2% and 3% of the village labor force would take the opportunity to commute, either on a year-round basis, or more likely, in the off-season months only. This kind of benefit seems applicable mainly to the more remote villages located at least 4 km from the existing road where time savings from substituting a bus for walking will be significant.

17. An attempt was made to quantify the benefits associated with better access to alternative employment opportunities, for roads 5 and 6 km long, assuming a town with non-farm employment opportunities, 20 km from the village. The following assumptions were made:

(a) The village is 4 km from the present bus route;

(b) The walking speed is 5 km/hr and the bus speed is 30 km/hr;

(c) The total rural population served by the new road was determined by the agricultural area, using the ratio 12 persons/1.83 ha of cultivated land (para 7);

(d) The commuting population would constitute 1% of the total population;

(e) Off-farm work in the nearby town would be for the off-season, from December to March. A rural commuter would work on the average 100 days/year. The daily wage would be Won 2,000 (US$4.12), with an opportunity cost of Won 450 (US$0.93);

(f) The cost of bus transport would be Won 10/person/km; and

(g) The build-up rate was assumed to be 50% in Year 2 and 100% in Year 3.

When these additional benefits were added to the basic agricultural benefits, the rate of return varied from 3.4% for the 6 km, 50 ha, 6 commuters, road to 26.7% for the 5 km, 200 ha, 24 commuters road. The results of the analysis are shown in Table 2 and Figure 1.

Conclusions

18. The foregoing analysis demonstrates that the proposed road construction component is likely to yield sizeable benefits and it proposes a method for their evaluation. However, it should be noted that the estimates of benefits are not only partial but also crude, in the absence of sufficient empirical evidence. The selection procedure also needs further refinements, in particular to take into account local variations in cropping patterns, topography and regional equity considerations. The project evaluation studies (para 5.17) should yield further empirical evidence of the impact of roads on the rural economy and help to refine and test the proposed sub-project selection procedures.

KOREA

RURAL INFRASTRUCTURE PROJECT

Economic Analysis of Rural Roads

Agricultural Input and Output Volumes[1/]

	Area (ha)	Yield (ton/ha)	Production (ton)	Domestic Consumption (ton)	Transportable Volume (ton)
INPUTS					
-fertilizer					0.67
-lime					0.50
OUTPUTS					
Paddy Land	1.0				
-Rice	1.0	3.5	3.50	1.50	2.00
-Barley	0.2	2.0	0.40	-	0.40
Upland	0.83				
-Barley	0.45	2.0	0.90	0.60	0.30
-Pulses	0.25	0.9	0.23	0.01	0.22
-Potatoes	0.12	15	1.80	0.45	1.35
-Vegetables	0.09	13	1.17	0.96	0.21
-Fruits	0.08	20	1.60	0.18	1.42
-Tobacco	0.08	1.8	0.14	-	0.14
-Other crops	0.16	1.0	0.16	0.06	0.10
					7.31

Source: Yearbook of Agriculture and Forestry Statistics, MAF, 1973 and 1974
Agricultural Sector Survey, Korea, IBRD, November, 1973.

1/ per 1.83 ha unit of farming land, comprising 1 ha of paddy plus 0.83 of upland.

KOREA

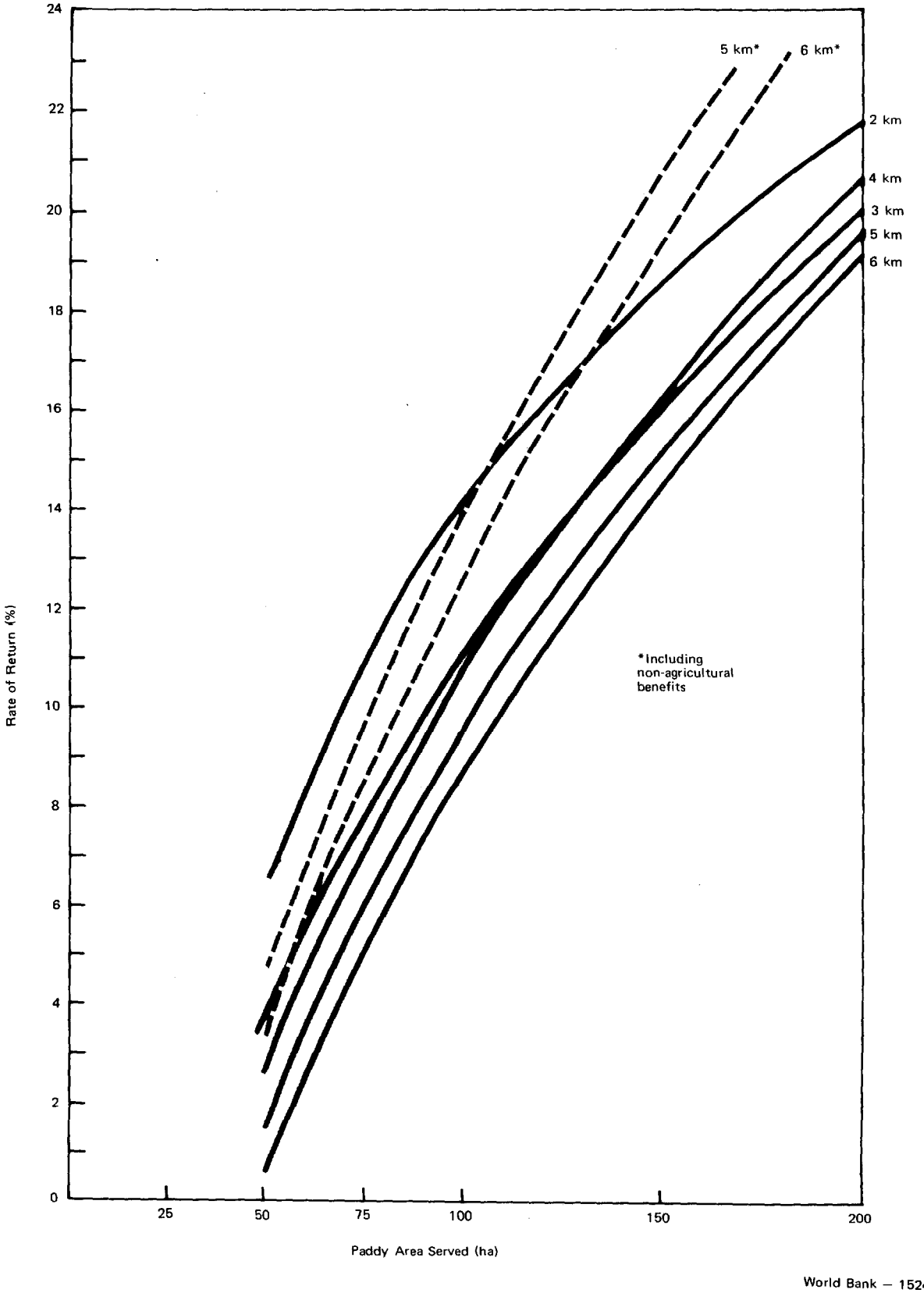
RURAL INFRASTRUCTURE PROJECT

Economic Analysis of Rural Roads

Rates of Return (%)

Road Length (km)	Paddy Land Served (ha)				
	50	75	100	150	200
2	6.6	10.7	14.3	18.5	21.8
3	3.6	8.0	11.2	16.1	20.1
4	2.7	7.1	10.7	16.3	20.6
5	1.5	6.0	9.6	15.2	19.7
6	0.6	5.0	8.6	14.5	19.1
Including Benefits from Non-Farm Employment					
5*	4.7	9.9	14.1	20.9	26.7
6*	3.4	8.4	12.6	19.4	25.1

KOREA
RURAL INFRASTRUCTURE PROJECT
ECONOMIC ANALYSIS OF RURAL ROADS



World Bank – 15245

KOREA

RURAL INFRASTRUCTURE PROJECT

Project Evaluation - Rural Electrification

1. The main benefits of the rural electrification component would be:

(a) an improvement in the quality of life in rural areas; and

(b) an increase in productivity, output and opportunities for new productive activities in rural areas.

2. In order to improve the quality of life in rural areas it is necessary to reduce the disparity in infrastructure endowment between urban and rural areas. This disparity has been particularly evident in access to electricity supply. In 1964, 51% of urban households had electricity, compared to 12% of rural households. As a result of rural electrification efforts undertaken since the enactment of the Rural Electrification Law in 1965, the number of electrified households increased dramatically. Between 1965 and 1974, 1.175 million rural households were supplied with electricity. By the end of 1975, 59% of rural households were electrified, in contrast to 93% of urban households.

3. While there is no evidence that rural electrification by itself is able to stem out-migration from rural areas, its indirect influence on the latter cannot be dismissed. Besides improving living conditions and providing access to such amenities as radio and television, electrification also has a direct stimulus to income-generating activities in the countryside, both by increasing the productivity of existing developments and by opening up opportunities for new activities, such as cottage industries.

4. There have been no systematic studies on the impact of rural electrification in Korea. Available evidence suggests, nevertheless, a strong and rapid response by rural households, particularly in the use of small power tools. A study of electricity consumption between 1969 and 1974, conducted by KECO in 200 randomly selected villages, showed that average monthly consumption per household has grown at an annual average rate of 13% increasing from 13.2 kWh in 1969 to 24 kWh in 1974. The increase in small power use has been even more impressive -- from a total of 537 kW of contracted demand in 1969, to 4,586 kW in 1974 - a 750% increase. In 1974, only about 0.3% of electrified rural households were classified as power consumers but they were responsible for 15-20% of rural power demand.

5. In the absence of empirical data, it is difficult to estimate the full economic benefits accruing to electricity consumers. It was therefore decided to adopt a "willingness to pay" approach to benefit measurement and to consider the actual monetary outlays by consumers (that is, KECO's revenues plus taxes) as a measure of benefits. Benefits derived this way are a minimum estimate of the total economic benefits of the project, as it is assumed that the consumers would have been willing to pay somewhat more than the actual charges for electricity and thus a consumers' surplus remains unmeasured.

6. The following general assumptions underlying the evaluation are made:

(a) Size of the project - 300,000 households, which will begin to use electricity in 1977; and

(b) Evaluation period - 35 years (1976 to 2011), corresponding to the amortization period for the Government's loans to the consumers.

Project Costs

7. The following costs were included in the analysis:

(a) Construction costs - KECO's estimates of the project costs (Annex 10, Table 7) were used. Transfer payments (taxes and import duties) were deducted. Capital costs include the necessary distribution facilities and the cost of house wiring. It was assumed that, in addition to the major construction, minor investments in distribution capacity would be undertaken by KECO every five years, in order to meet the projected growth in electricity demand;

(b) Generation and Transmission Costs - In order to simplify the analysis, bulk power costs were estimated using KECO's tariffs for large power consumers; and

(c) Operation and Maintenance Costs - These include distribution costs, and administrative and general expenses. They were estimated on the basis of pro-rated actual system-wide 1974 expenditures, 1/ adjusted to early-1976 prices.

Project Revenues

8. As discussed in para 5, the project benefits are measured by the actual monetary outlays by the benefitting households, which is the sum of:

(a) Revenues from electricity sales -- estimated separately for domestic and small power consumers;

(b) Electricity tax -- paid by consumers and equal to 15% of electricity sales;

(c) Loan repayments by the beneficiaries; and

(d) Payments by householders for house wiring.

Demand Forecast

9. The forecast of the future demand for electricity was based upon measurements of demand following past rural electrification investments. KECO's study of 200 villages provided the basic data. It was assumed that the demand would follow an S-shaped curve. The rate of growth would increase rapidly during the first five years of the project, as newly connected customers install lights and simple appliances. The peak of the growth rate is assumed to be reached in the fifth year, with a declining rate of growth thereafter and a constant rate from the eighth year. For the purposes of analysis, it was assumed that growth in demand would cease after twenty years. It was also assumed that small power use would grow more rapidly than the domestic use. The percentage of small power use was estimated to increase from 23% of total consumption in 1976 to about 36% in 2011. The average initial load for domestic use was estimated at 9.5 kWh/month/household. It was assumed that the number of domestic consumers would remain constant throughout the life of the project. The domestic use load in Years 22 to 35 was therefore computed at 81 kWh/month/household. The

---

1/ (a) Distribution costs for the project = KECO's total distribution costs x $\frac{\text{Net fixed assets of the component}}{\text{Net fixed assets of KECO's system}}$

(b) Administrative and general expenses = KECO's total expenses x $\frac{\text{No. of customers served by the component}}{\text{No. of customers served by KECO}}$

average initial load for small power use was estimated at 1,200 kWh/month for 1,500 consumers - 0.5% of the number of households electrified by the project. The small power load in 2011 was estimated at 6,000 kWh/month. The number of power consumers would then reach over 3,100 or 1% of households electrified by the project. These demand forecast data are summarized in Table 1. The initial load assumed for both domestic and small power use is lower than the actual load for sample villages in KECO's study mentioned above. The long-term rate of growth is below forecasts for the total system made both by KECO and by the Bank's Power Sector Review, because the project villages are smaller and more remote than those previously connected and opportunities for industrial use will be fewer.

Revenues

10. Revenues from sales of electricity were derived by estimating the average monthly consumption per household and per small power user and multiplying these by the current KECO tariffs for domestic and small power use (Table 2). According to the level of consumption, prices for domestic use vary from Won 35.9/kWh to Won 28.3/kWh; and from Won 31 to Won 23.8/kWh for small power using the 1975 tariff schedule. Tax payments were added and loan repayments estimated using the amortization plan discussed in Annex 14. The payment for house wiring merely offsets the cost of that item in Year 1 and therefore does not appear in Table 2.

Rate of Return

11. Based on the assumptions listed above and using a 35-year period of evaluation, the minimum estimate of the economic rate of return was found to be equal to 10% (Table 2). The following sensitivity tests were carried out:

(a) a 15% increase in construction costs - the resulting economic rate of return was 9%;

(b) a 20% increase in tariffs - the resulting economic rate of return was 16% (neglecting price elasticity, which is normally low for domestic power use); and

(c) a 10% decrease in sales revenues, corresponding approximately to an 8.5% decrease in demand - the resulting economic rate of return was 6%.

These results indicate a moderate sensitivity to forecast demand and price.

12. It is believed that the above estimate of the economic rate of return is a conservative one, for the following reasons:

(a) No attempt was made to evaluate the consumers' surplus. The evidence of a rapid build-up in demand when electricity is provided suggests that consumers' surplus is sizeable; and

(b) A sensitive variable for the estimation of benefits is the level of tariffs. The tariff structure used was that adopted in December, 1974. The cost estimates, on the other hand, have been adjusted to early-1976 levels. Tariffs have subsequently been adjusted (December, 1975) to allow for cost increases in 1975. According to the recent Power Sector Review, tariffs, especially for domestic use, are still probably too low and do not reflect the full economic cost of electricity supply. Sensitivity analysis (para 11) shows a significant improvement to the rate of return estimate following from an increase in tariffs of 20%.

KOREA

RURAL INFRASTRUCTURE PROJECT

Rural Electrification

Demand Forecast

	Consumption (GWh)			Rate of Growth (%)		
Year	Domestic Use	Small Power	Total	Domestic Use	Small Power	Total
1	-	-	-	-	-	-
2	70.0	21.6	91.6	8	12	8.7
3	75.8	24.1	100.0	10	12	10.5
4	83.4	27.0	110.0	12	13.5	12.3
5	93.4	30.7	124.1	13.5	15	13.7
6	106.0	35.3	141.3	15	18	15.6
7	121.9	41.7	163.6	10	13.5	10.9
8	134.1	47.3	181.4	8	12	9.0
9	144.8	53.0	197.8	6	10	6.8
10	153.5	58.3	211.8	6	10	7.1
11	162.7	64.1	226.9	6	10	7.1
12	172.5	70.6	243.1	6	10	7.2
13	182.8	77.6	260.5	6	10	7.2
14	193.8	85.4	279.2	6	10	7.2
15	205.4	93.9	299.4	6	10	7.2
16	217.7	103.3	321.1	6	10	7.3
17	230.8	113.7	344.5	6	10	7.3
18	244.7	125.0	369.7	6	10	7.3
19	259.3	137.6	396.9	6	10	7.4
20	274.9	151.3	426.3	6	10	7.4
21-35	291.4	166.4	457.9	-	-	-

KOREA

RURAL INFRASTRUCTURE PROJECT

Economic Analysis of Rural Electrification
(Won billion)

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22-35
BENEFITS																						
Sales Revenue																						
- Domestic Use	-	2.5	2.6	2.8	3.1	3.4	3.7	4.0	4.3	4.6	4.8	5.1	5.3	5.7	6.0	6.3	6.7	7.2	7.7	8.3	9.0	9.0
- Small Power	-	0.7	0.8	0.8	0.9	1.0	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.1	2.3	2.5	2.7	2.9	3.1	3.4	3.4
Electricity Tax	-	0.5	0.5	0.5	0.6	0.7	0.7	0.8	0.9	0.9	1.0	1.0	1.1	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.8
Loan Repayment	-	1.2	1.2	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
TOTAL BENEFITS	-	4.9	5.1	5.3	5.8	6.3	6.9	7.4	7.9	8.3	8.7	9.1	9.5	10.0	10.6	11.2	11.9	12.7	13.5	14.4	15.4	15.5
COSTS																						
Investments	15.5	-	-	-	-	0.8	-	-	-	-	0.8	-	-	-	-	0.8	-	-	-	-	0.8	-
Operation and Maintenance	-	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
Generation and Transmission	-	2.0	2.2	2.4	2.7	3.1	3.5	3.9	4.2	4.5	4.8	5.1	5.5	5.9	6.4	6.8	7.3	7.8	8.4	9.0	9.7	9.7
TOTAL COSTS	15.5	4.1	4.3	4.5	4.8	6.0	5.6	6.0	6.3	6.6	7.7	7.2	7.6	8.0	8.5	9.7	9.4	9.9	10.5	11.1	12.6	11.8
NET BENEFITS	-15.5	0.8	0.8	0.8	1.0	0.3	1.3	1.4	1.6	1.7	1.0	1.9	1.9	2.0	2.1	1.5	2.5	2.8	3.0	3.3	2.8	3.7

Economic Rate of Return = 10%

ANNEX 21
Table 2

KOREA

RURAL INFRASTRUCTURE PROJECT

Cost Recovery - Minor Irrigation and Upland Reclamation

1. This Annex examines the implications for the project area farmers of alternative policies towards the recovery of the capital and recurrent costs of the minor irrigation and upland reclamation components.

A. Minor Irrigation

Assumptions

2. As in the evaluation of the minor irrigation component (Annex 17), three farm sizes, 0.5 ha, 0.9 ha and 1.8 ha, have been used to represent small, average and large farms respectively. As no surveys have been made in the actual sub-project areas, national average data has been used in determining the numbers of project area farms in each category. Farm budget data (Annex 17, Tables 2, 3 and 4) has been used to derive the net incremental income due to the project for each farm size (Table 1). Production taxes have been calculated, using the present rate of 6% of all grain production in excess of 1.4 ton/farm. This tax structure exempts the estimated subsistence output and is thus progressive with farm size. Indirect taxes, such as import duties and sales taxes have not been considered, due to a lack of data.

Alternative Water Charges Policies

3. The alternative measures examined are listed in Table 2. As Korea already has a well-established mechanism for cost recovery on irrigation projects (which treats capital and recurrent costs separately), the alternatives chosen consist of different levels of charges within this mechanism. Alternative 1 is the collection of operation and maintenance (O&M) costs only. Recovery of less than this amount would be impracticable as the Farmland Improvement Associations rely on water charges to finance the O&M costs of the system. Alternative 2 is the present Government policy, recovery of O&M costs plus 30% of capital costs at 3.5% interest over 35 years, including a five-year grace period (Annex 14). Alternative 3 represents the Government policy prior to 1973 (recovery of O&M costs plus 40% of capital costs), which the Government has undertaken to follow for the ongoing irrigation projects financed by the Bank Group. 1/ Alternatives 4 and

---

1/ A reduction in the rate of cost recovery is appropriate for the present project, as the minor irrigation sub-projects do not include paddy rearrangement and would benefit poorer and more remote villages than the previously-assisted large-scale projects.

5 provide for recovery of 60% and 100% respectively of all costs, at the low 3.5% interest rate currently used in Korea. Alternative 6 provides for recovery of all costs at 10% interest, which represents the estimated opportunity cost of capital in Korea. Given the fairly low economic rate of return, recovery rates above this level would be unrealistic from a farm income point of view.

4. The cost recovery ratio (defined as the ratio of the present worth of the stream of direct government revenues from water charges divided by the present worth of the cost stream, both discounted at 10%) for each alternative is shown in Table 2. The ratios vary between 12% and 100%. The benefit recovery ratio (defined as the ratio of the present worth of the stream of direct government revenues from water charges divided by the present worth of the stream of incremental farm income net of production taxes) for each alternative and farm size is also shown in Table 2. For Alternative 2, the cost recovery ratio would be 23% while the benefit recovery ratios vary from 24% to 31%.

Ability to Pay

5. As volumetric measurement of water consumption for irrigation is not yet practicable in Korea, water pricing would have little effect on the efficient allocation of the water resource. Pricing policy therefore is more concerned with equity (between irrigated and non-irrigated farmers and between the rural and urban sectors) and ability to pay. The incremental farm income due to the project is shown in Table 1 for each farm size. For the average size farm (Farm 2) the increment equals Won 323,000 (US$670), or about US$100 per capita. This income represents a return to the project investment (the "project rent"), a return to the farmer's own investment in farm equipment, land improvement, farm storage and so on, a return to the additional family labor used to produce the incremental income, and a return to the management skill of the farmer. These factors cannot be evaluated precisely for the following reasons:

(a) As agriculture in Korea, even without irrigation, is quite intensive, the increment of labor due to the project is relatively small (about 20 man-days/ha) and difficult to determine very accurately, without survey data;

(b) Management skill cannot be easily quantified in monetary terms; and

(c) The farmer's investments in equipment and farm improvements can only be estimated approximately, without detailed socio-economic surveys.

6. Incremental family labor was separated from the total incremental labor due to the project and valued at Won 2,000/man-day, which is 10% above the market wage rate for hired labor during the crop season (which assumes that family labor is slightly more productive). The value of management was

assumed to be 15%, 25% and 35% of incremental income for the three farm sizes, reflecting the increasing complexity of managing larger farms. These figures are rather higher than would be appropriate in most other countries, reflecting the high level of management and heavy use of inputs in Korea. The return to the farmer's own investment was assumed to be 10% of net incremental income. The remaining incremental income varies from Won 122,000 (US$250) for Farm 1 to Won 276,000 (US$570) for Farm 3.

7. The remaining incremental income, after deducting the returns to the other factors of production, is subject to a high degree of uncertainty, due to year to year fluctuations in gross income (due to weather, pests and diseases and other sources) and the "certainty equivalent" of the residual incremental income (the guaranteed annual sum which would have the same utility to the farmer) would be significantly less than the mean value computed above. Surveys in many countries have shown that, if the farmer is to assume the risk inherent in purchasing inputs with credit and in planting a crop, he will require the prospect of a financial return above the strict compensation for his labor, management and investment. In addition, allowance should be made that the above estimates are averages only and based on uncertain estimates of the many variables involved -- individual incomes may vary widely from these averages. For these reasons, the project rent has been estimated at 50% of the residual incremental income for the average-sized farm. As risk is more significant for a small farmer, the project rent has been assumed to vary with farm size, from 40% of residual incremental income for Farm 1 to 60% for Farm 3.

Optimum Level of Water Charges

8. Assuming that all project rent is spent for consumption and not saved, the optimum rates of water charges would be zero for those households with income below the "critical consumption level" and 100% of the project rent for those with incomes above that level. According to recent Bank estimates, the critical consumption level (or relative poverty level) for Korea includes 25% of the rural population. As the sub-project areas are known to be somewhat worse off than the national rural average, it has been assumed that all the 34% of sub-project area farms represented by Farm Model 1 (Annex 17) have incomes before the project below the critical consumption level.

9. On the above reasoning, the optimum level of water charges would be close to Alternative 4 for farms over 0.5 ha (Table 2) and zero for those 0.5 ha and below (para 8). The Government's present policy (Alternative 2) represents about 70% of the project rent for the larger farmers and 50% for the small owners which is much more than the theoretical optimum of zero. Dividing total revenues from taxes and charges by the total project rent, the Government's proposals would imply an overall rent recovery index of about 80%. This is regarded as a reasonable practical solution for the following reasons:

(a) The Government's policy is uniform for the whole country and is laid down by law. Adopting a different policy for this project would be politically and administratively difficult;

(b) The theoretically optimum cost recovery would be highly progressive with farm size -- the Government's proposals are mildly so. Highly progressive rates would be difficult to administer and would invite evasion by sub-division of holdings;

(c) The deviations between the proposed charges and the optimum level are not great enough to cause serious inequities in income distribution;

(d) Part of the O&M charge in Korea is used to pay for extension services. In most countries, these services are fully subsidized by the Government. If this cost were omitted from the costs to be recovered, the cost recovery ratio would be higher; and

(e) In comparing Korea's performance with other countries, credit should be given to the fact that collections of water charges in Korea are commonly greater than 98% of assessments.

Conclusion

10. For the above reasons, the proposed water charges appear satisfactory.

B. Upland Reclamation

11. For the upland reclamation component, credit is provided for 30% of the project cost, with interest at 9% and repayment over eight years (Annex 14). The proposed terms imply a cost recovery ratio of 28% (using a discount rate of 10%), compared to about 23% for the minor irrigation component. As the beneficiaries of both components are at similar income levels, a similar level of cost recovery appears appropriate. While the rate of return for upland reclamation would be higher (Annex 18), the risk of crop loss is also higher (as the upland areas are fully dependent on rainfall) and a higher allowance for risk and uncertainty would need to be made. Therefore, it may be assumed that the maximum feasible cost recovery charges would be similar for both components.

KOREA

RURAL INFRASTRUCTURE PROJECT

Effect of Cost Recovery on Farm Income

Farm Model	1	2	3
Farm area (ha)	0.5	0.9	1.8
% of farms	34	32	34
% of area	11	27	62
Farm Income (Won '000)			
Present	341	540	918
Future Without Project	393	622	1,056
Future With Project	580	945	1,649
Increment due to Project	187	323	593
Production Tax (Won '000)			
Present	0	1	17
Future Without Project	0	8	26
Future With Project	5	24	61
Increment due to Project	5	16	35
Water Charges (Won '000)			
Operation and Maintenance	10	18	37
Debt Service (Year 7)			
- Alternative 1	0	0	0
- Alternative 2	10	19	39
- Alternative 3	14	26	51
- Alternative 4	21	40	77
- Alternative 5	36	64	128
- Alternative 6	91	175	300
Total Charges and Taxes			
- Alternative 1	15	42	98
- Alternative 2	25	61	137
- Alternative 3	29	68	149
- Alternative 4	36	82	175
- Alternative 5	51	106	226
- Alternative 6	106	217	398

ANNEX 22
Table 2

KOREA

RURAL INFRASTRUCTURE PROJECT

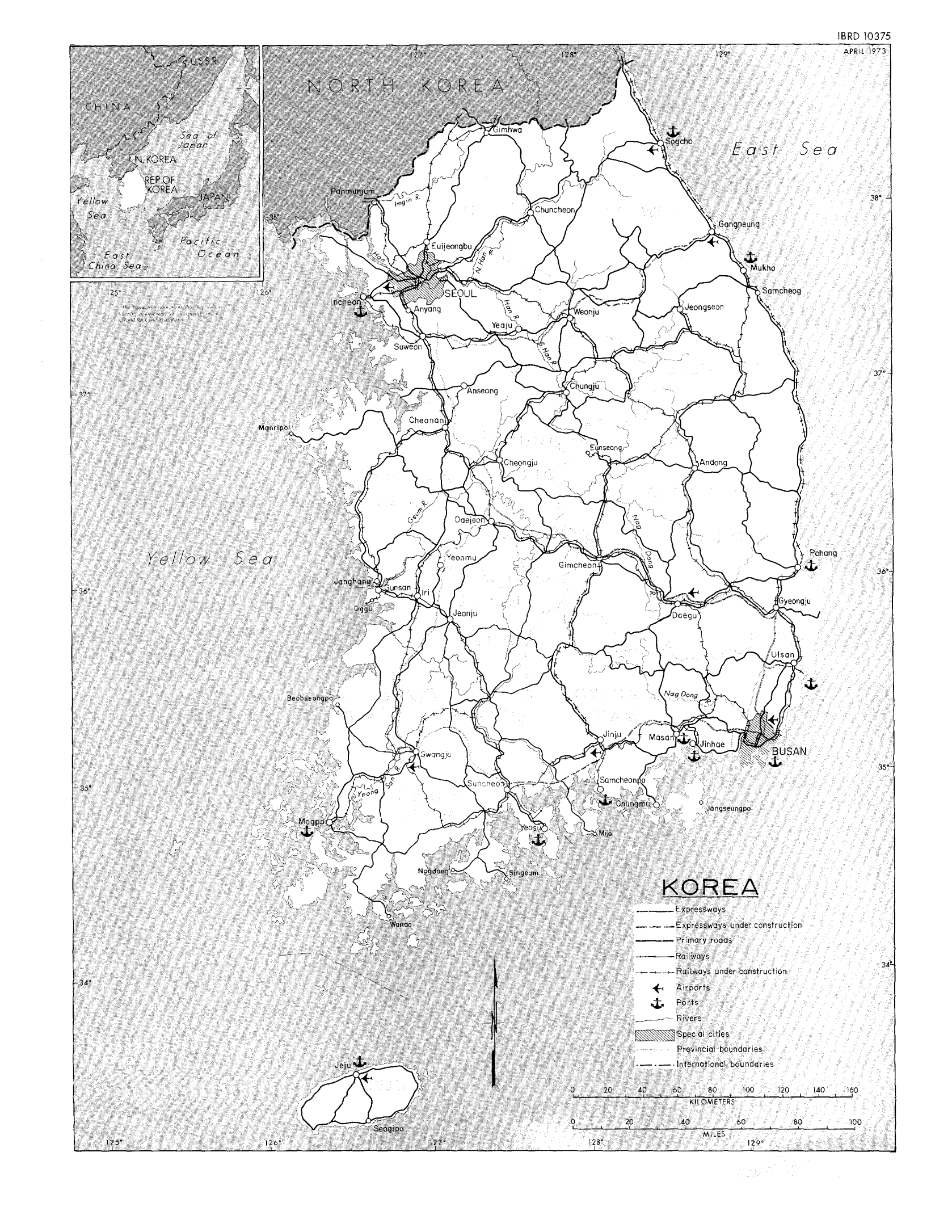
Cost Recovery and Project Rent

Alternative No.	1	2	3	4	5	6
% Recovery of						
- O&M Costs	100	100	100	100	100	100
- Capital Costs	0	30	40	60	100	100
Interest rate (%)	-	3.5	3.5	3.5	3.5	10
Cost Recovery Ratio (%)	12	23	27	34	49	100
Benefit Recovery Ratio (%) - Farm 1	12	24	28	36	51	108
- Farm 2	13	27	31	41	55	126
- Farm 3	14	31	35	45	63	123
Charges and taxes as % of						
incremental income - Farm 1	8	13	15	19	27	57
- Farm 2	13	19	21	25	33	67
- Farm 3	16	23	25	29	38	67

Project Rent	Farm 1	Farm 2	Farm 3
Total Incremental Labor (man-days)	9	26	42
Incremental Family Labor (man-days)	9	26	25
Incremental Income (Won '000)(From Table 1)	187	323	593
Less: Return to Labor (Won '000)	18	52	50
Less: Return to Management (Won '000)	28	81	208
Less: Return to Own Investment	19	32	59
Sub-Total: Residual Incremental Income	122	158	276
Certainty Equivalent (%)	40	50	60
Project Rent (Won '000)	49	78	166
Actual Total taxes and charges - Alternative 2	25	52	109
- Alternative 4	36	73	147
Rent recovery index - Alternative 2 (%)	51	67	66

IBRD 10375

APRIL 1973



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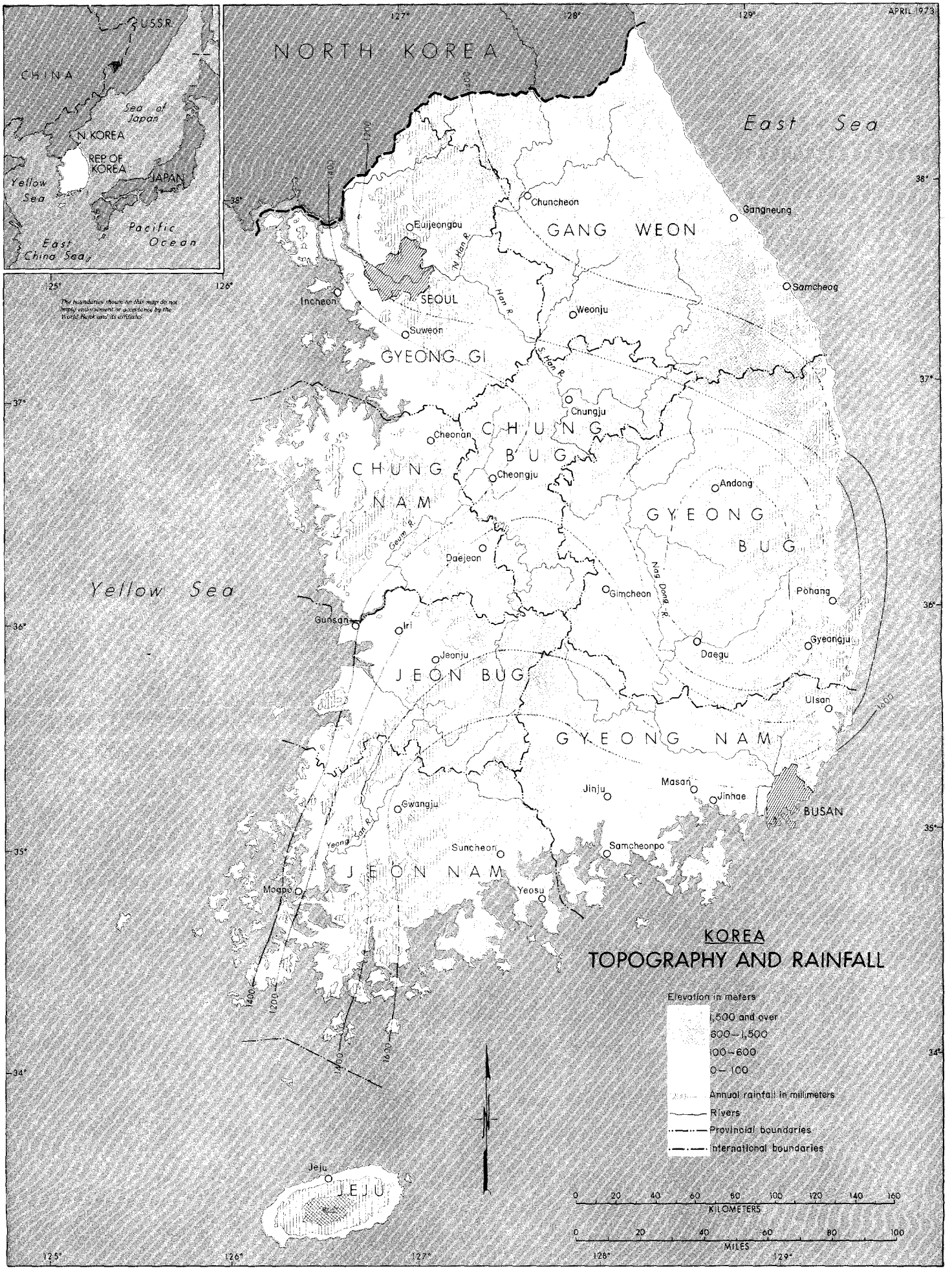
APRIL 1973



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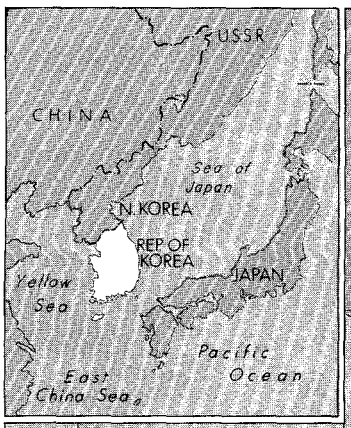


KOREA
POPULATION
(31.84 MILLION AS OF 1970)

Population density (per square kilometer) by Guns:

- More than 1,000
- 301 - 1,000
- 201 - 300
- 101 - 200
- Less than 100

- District boundaries (Guns)
- Provincial boundaries
- International boundaries

NORTH KOREA
East Sea
Yellow Sea

GANG WEON
GYEONG GI
CHUNG BUG
CHUNG NAM
GYEONG BUG
JEON BUG
JEON NAM
GYEONG NAM
JEJU

GOSEONG, CHEOLWEON, HWACHEON, YANGGU, SOGCHO, INJE, YEONCHEON, POCHEON, CHUNSEONG, YANGYANG, GAPYEONG, CHUNCHEON, HONGCHEON, GANGNEUNG, PAJU, ONGJIN, GANGHWA, GIMPO, EUIJEONGBU, YANGJU, GOYANG, PYEONGCHANG, MEONGJU, CITY OF SEOUL, INCHEON, YANGPYEONG, HOENGSEONG, GWANGJU, BUCHEON, SIHEUNG, SUWEON, WEONJU, JEONGSEON, YEOJU, WEONSEONG, SAMCHEOG, ICHEON, YONGIN, HWASEONG, YEONGWEOL, JECHEON, JUNGWEON, ANSEONG, DANYANG, PYEONGTAEG, EUMSEONG, CHUNGJU, BONGHWA, ULJIN, JINCHEON, YEONGJU, DANGJIN, CHEONWEON, CHEONAN, ASAN, GOESAN, SEOSAN, YEONGYANG, MUNGYEONG, YECHEON, ANDONG, YESAN, YEONGI, CHEONGJU, CHEONGWEON, HONGSEONG, GONGJU, BOEUN, YEONGDEOG, CHEONGYANG, DAEDEOG, DAEJEON, SANGJU, OGCHEON, EUISEONG, CHEONGSONG, BORYEONG, BUYEO, SEONSAN, YEONGIL, NONSAN, GEUMSAN, YEONGDONG, GIMCHEON, GUNEUI, POHANG, SEOCHEON, IGSAN, GUNSAN, GEUMREUNG, CHILGOG, YEONGCHEON, OGGU, IRI, WANJU, MUJU, SEONGJU, DAEGU, WEOLSEONG, GYEONGJU, GIMJE, JEONJU, JINAN, GYEONGSAN, BUAN, GEOCHANG, DALSEONG, SORYEONG, CHEONGDO, JEONGEUB, IMSIL, JANGSU, HAMYANG, HAPCHEON, CHANGNYEONG, ULJU, ULSAN, MILYANG, GOCHANG, SUNCHANG, NAMWEON, SANCHEONG, EUIRYEONG, YANGSAN, DONGHAE, YEONGWANG, DAMYANG, GOGSEONG, GURYE, JINYANG, HAMAN, MASAN, GIMHAE, BUSAN CITY, HAMPYEANG, HWANGSAN, GWANGJU, HADONG, JINJU, CHANGWEON, JINHAE, SEUNGJU, SACHEON, GOSEONG, GWANGYANG, SAMCHEONPO, MUAN, NAJU, HWASUN, SUNCHEON, CHUNGMU, GEOJE, SINAN, MOKPO, YEONGAM, BOSEONG, YEOSU, NAMHAE, TONGYEONG, YEOCHEON, JANGHEUNG, GANGJIN, HAENAM, GOHEUNG, JINDO, WANDO, JEJU, BUGJEJU, NAMJEJU

0 20 40 60 80 100 KILOMETERS
0 20 40 60 MILES

POPULATION BY CITY AND PROVINCE

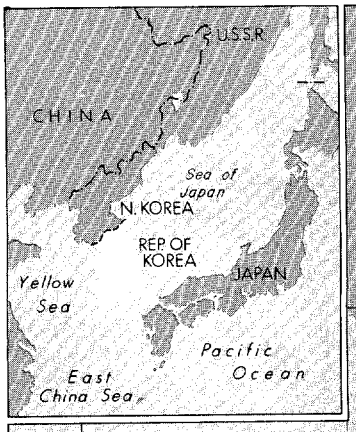
		Total population (1970)	Farm population
1	SEOUL CITY	5,525,262	1,000,000
2	BUSAN CITY	1,876,000	200,000
3	GYEONG GI	3,349,000	1,800,000
4	GANG WEON	1,860,000	1,200,000
5	CHUNG BUG	1,395,000	1,000,000
6	CHUNG NAM	2,652,000	1,800,000
7	JEON BUG	2,259,000	1,600,000
8	JEON NAM	4,184,000	3,000,000
9	GYEONG BUG	3,349,000	2,200,000
10	GYEONG NAM	3,349,000	2,200,000
11	JEJU	250,000	200,000

Thousands 0 1000 2000 3000 4000 5000 6000

As of October 1971, *Year Book of Agricultural and Forestry Statistics*, (Ministry of Agriculture and Forestry), Korea.

IBRD-10378

APRIL 1973



The boundaries shown on this map do not imply endorsement or acceptance by the World Bank and its affiliates.

NORTH KOREA

East Sea

Yellow Sea

GANG-WEON

GYEONG GI

CHUNG BUG

CHUNG NAM

GYEONG BUG

JEON BUG

JEON NAM

GYEONG NAM

JEJU

GOSEONG, CHEOLWEON, HWACHEON, YANGGU, INJE, GOSEONG, YANGYANG, YEONCHEON, POCHEON, GAPYEONG, CHUNCHEON, CHUNSEONG, GANGNEUNG, GANGHWA, ONGJIN, EUIJEONGBU, HONGCHEON, WONJU, GWANGJU, GIMPO, GOYANG, YANGJU, YANGPYEONG, HOENGSEONG, PYEONG CHANG, CITY OF SEOUL, JUNGSEON, SAMCHEOG, INCHEON, SUWEON, YEOJU, WONSEONG, YONGIN, ICHEON, YEONGWOL, HWASEONG, JECHEON, JUNGWEON, DANYANG, ANSEONG, CHUNGJU, EUMSEONG, PYEONGTAEG, CHEONWEON, JINCHEON, DANGJIN, CHEONAN, SEOSAN, ASAN, YESAN, HONGSEONG, CHEONGYANG, CHEONGJU, BOEUN, YEONGYANG, ANDONG, YEONGDEOG, GONGJU, SANGJU, CHEONGSONG, BUYEO, DAEDEOG, OGCHEON, SEOCHON, NONSAN, GEUMSAN, YEONGDONG, GUMI, SEONSAN, GUNEUI, POHANG, IKSAN, GUMCHEON, CHILGOG, YEONGCHEON, GYEONGJU, OGSU, GWANJU, MUJU, JINAN, JEONJU, SEONGJU, GIMJE, SEOCHANG, GOCHANG, SUNCHANG, NAMWON, HAMYANG, HAPCHEON, CHANGNYONG, YANGSAN, ANSEONG, DANYANG, YEONGWANG, GOSEONG, GURYE, SANCHEONG, HADONG, GIMHAE, BUSAN CITY, GWANGYANG, SUNCHEON, NAMHAE, GOSEONG, SACHEON, TONGYEONG, YEOCHEON, SUNCHEON, GANGJIN, JANGHEUNG, GOHEUNG, HAENAM, JEJU, BUGJEU, SEOGWIPO

KOREA
LAND USE
(AS OF 1971)

Paddy and upland rice

Barley, wheat and rye

(One dot represents 1,000 hectares)

District boundaries (Guns)

Provincial boundaries

International boundaries

0 20 40 60 80 100 120 140 160 KILOMETERS

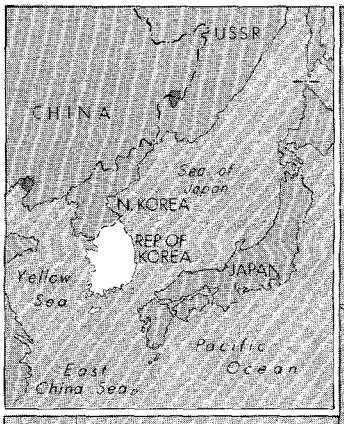
0 20 40 60 80 100 MILES

125° 126° 127° 128° 129°

38° 37° 36° 35° 34°

IBRD 10380

APRIL 1973



The boundaries shown on this map do not imply official endorsement or acceptance by the World Bank and its affiliates.

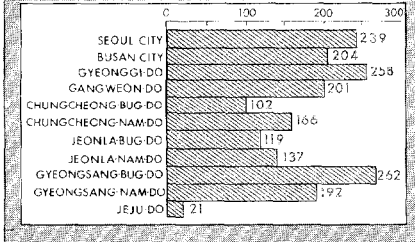
NORTH KOREA

East Sea

Yellow Sea

Gimhwa
Sogcho
Panmunjum
Imgin R.
Chuncheon
GANG WEON
Gangneung
Hoeng R.
Eutjeongbu
N. Han R.
SEOUL
Incheon
Anyang
Suweon
Yeaju
Mukho
Samcheog
Weonju
Jeongseon
S. Han R.
GYEONG GI
Anseong
Chungju
CHUNG CHEONG NAM BUG
Cheonan
Manripo
Eunseong
Cheongju
Andong
GYEONG SANG BUG
Daejeon
Yeonmu
Gimcheon
Nag Dong R.
Pohang
Geum R.
Janghang
Gunsan
Iri
Oggu
JEON LA BUG
Jeonju
Daegu
Gyeongju
Ulsan
Beobseongpo
GYEONG SANG NAM
Nag Dong
Jinju
Masan
Jinhae
BUSAN
JEON LA NAM
Gwangju
Yeong San R.
Suncheon
Samcheonpo
Chungmu
Jangseungpo
Mogpo
Yeosu
Mijo
Nogdong
Singeum
Wando
Jeju
JEJU
Seogipo

SAWMILLS BY PROVINCES



LOCATIONS OF MAJOR FOREST INDUSTRIES BY CITIES

CITY	PLY MILLS	PULP MILLS	PAPER MILLS	CHIP BOARD	HARD BOARD
SEOUL		3	7		
INCHEON	3			2	
ANYANG			7		1
DAEJEON			1		
GUNSAN	3	1	2		
JEONJU		1	1		
BUSAN	6		2	1	

KOREA

LOCATION OF MAJOR FOREST INDUSTRIES

Major forest industries
14 Selected areas for large scale industrial plantations
National forests
Railways
Primary roads
Rivers
Special cities
Provincial boundaries
International boundaries

0 20 40 60 80 100 120 140 160
KILOMETERS
0 20 40 60 80 100
MILES

125° 126° 127° 128° 129°
38° 37° 36° 35° 34°

IBRD-10447

MAY 1973